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## THE SEASONALITY AND OCCURRENCE OF BIRDS IN THE EASTERN GHATS OF ANDHRA PRADESH<sup>1</sup>

TREVOR D. PRICE<sup>2</sup>

*(With a plate and thirteen text-figures)*

It is well known that seasonal climates have a marked effect on the annual cycle of birds. In the tropics, seasonality in rainfall has been shown to affect birds' annual cycles in Sarawak (Fogden 1972) and Panama (Karr 1976a) through an effect on the food supply. I spent one year from August 23rd 1976 until August 2nd 1977 in the Eastern Ghats of Andhra Pradesh, India, mainly at one locality, (the village of Lammasinghi) and visited again in 1978 from January 5th to February 10th. The intention was to document the seasonal occurrence of bird species and seasonality in the resident species, and relate this to the food supply. This was primarily an over-Winter investigation and attention was paid to the appearance and possible impact of Palaearctic migrants, which is poorly understood (Chipley 1976), particularly in India (Karr 1976b).

Whistler and Kinnear (1932) in the introduction to their pioneering report on the avifauna of the Eastern Ghats of India remarked that the area was ornithologically the least known in India. Their report did much to rectify the situation at that time, but since then little more information has been added (for a notable exception see Abdulali 1945, 1953), so that once again the area, particularly the Ghats in Andhra Pradesh and Orissa is comparatively poorly known.

Besides the intrinsic interest in having complete and detailed species lists for any area, there are at least two reasons why it is important to increase our knowledge of bird life in the Eastern Ghats. The first is that much of the natural forest is being rapidly removed for agriculture and monoculture plantations. This is having a profound effect on species diversity (Ripley 1979) and needs to be documented. The second concerns the controversy over the presence of Himalayan species in peninsular mountain ranges. Hora (1949) sug-

<sup>1</sup> Accepted February 1979.

<sup>2</sup>Division of Biological Sciences, Natural Science Building, Ann Arbor, Michigan 48109, U.S.A.

gested that the Satpuras had provided an important migration route to the mountains of south west India, while Abdulali (1949) thought that the Eastern Ghats route may have been equally important. Modern island biogeography theory (MacArthur and Wilson 1967) hypothesizes that each mountain range has relict species "stranded" after climatic amelioration, and makes interesting predictions about the numbers of species in relation to highland area. India is the ideal place to test these predictions.

LOCALITY, CLIMATE AND STUDY AREA

Lammasinghi (altitude c. 850 metres) is situated on a watershed in the south east edge of the Eastern Ghats (figure 1). To the east there is a steep drop to the 65 kilometre wide coastal plain. To the north and south hills rise a further 300 metres, and to the west stretches the Chintapalli plateau, much of it deforested

for cultivation although mature forest remains on many of the hillsides rising from the plateau, and on the ghatface itself. The forest type at Lammasinghi is tropical moist deciduous (see below). Other habitats in the vicinity include moist semi-evergreen forest (notably in the Gudem-Merripakala area); dry deciduous forest and open grassland on mountain tops; perennially cultivated wetlands at higher altitudes (for example around Solabum) and the cultivated, moist, coastal plain. Champion and Seth (1968) describe the forest types in detail.

The climate is highly seasonal, with three seasons recognised. 1) A monsoon season from June to September when most of the rainfalls and storms may be violent. 2) A winter season from October to February—temperatures may fall below 10°C, rain is very rare and thick fogs persist up to three hours from dawn. 3)

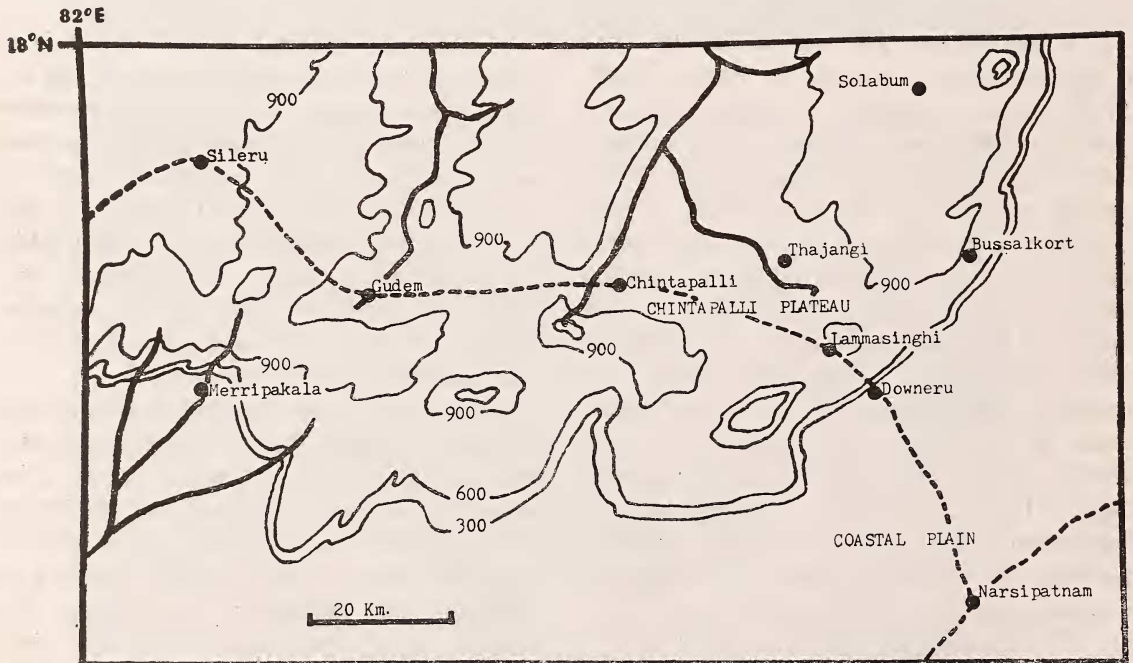


Fig. 1. Map of the Chintapalli Plateau showing villages mentioned in the text, roads (dotted), rivers, and contour lines at 300 metre intervals.

A Spring season from March to May—characterised by increasing amounts of rainfall, especially as convection storms in the afternoon; it can also be dry and hot with maximum temperatures (up to 40°C) recorded at this time of year.

Figure 2 gives available data on total rainfall for two extreme years, and figure 3 shows the number of rainy days per week and mean

1976-1977 Winter, while 1977 was exceptionally wet (due to unusually heavy rainfall in April, May and November), and the area much more moist during the 1977-1978 Winter.

Two study areas were set up, about 1½ kilometres apart in adjacent habitats. The first, on a hillside was under mature forest. This forest is characterised by straight boled tree

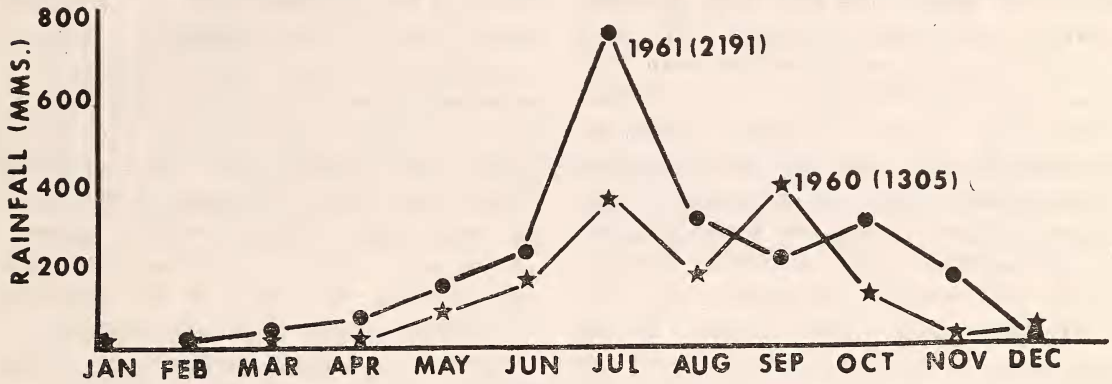


Fig. 2. Monthly rainfall for the years 1960 and 1961. Total rainfall (in mm) for each year is given in parentheses.

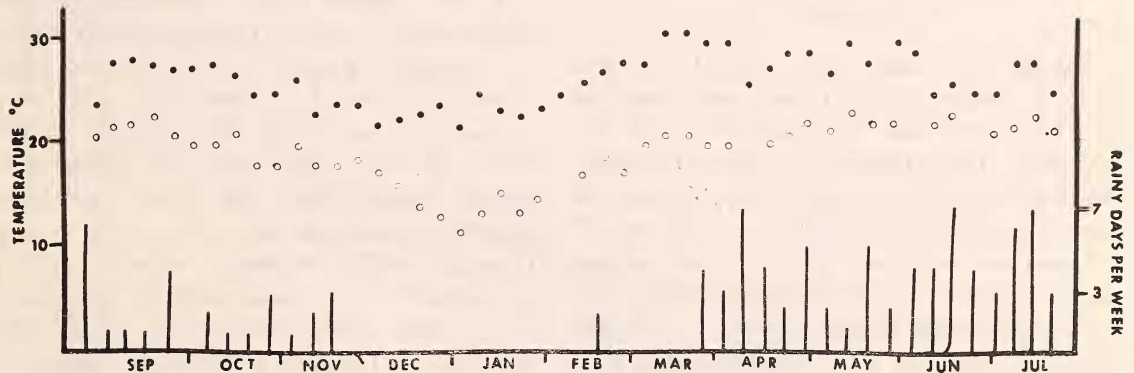


Fig. 3. Temperature and rainfall data during the 1976-1977 study period. Dots represent mean weekly temperature at 1300 hours, open circles mean weekly temperature at 0500 hours, and the histogram the number of days with rain each week.

weekly temperatures, taken daily at 0500 and 1300 during the main study period (1976-1977). Qualitatively 1976 was atypically dry so that the area was very desiccated during the

species and a canopy at 13-23 metres. 114 trees were enumerated along a transect line. They grouped into 30 species with *Grewia tiliaefolia*, *Schleichera oleosa* and *Pterocarpus*

*marsupium* dominant. The understory is poorly developed and regularly burnt through towards the end of the dry season (March-April).

The second (=“main”) study area was in secondary growth below the hill, which although desiccating considerably during the dry season remains wetter than the hillside, and such trees as *Ficus tsiela* and *Mangifera indica* are found. Some trees have been selectively retained in the square kilometre study area: 114 of 38 species were identified with *Syzygium cuminii* and *Mangifera indica* dominant. Bushes (e.g. *Lantana camara*), shrubs, and regenerating trees grow up to seven metres high, although there are open spaces maintained by heavy grazing and firewood collecting. In addition there are fields cultivated during the monsoon interspersed and some paddy lands along a small stream. In both study areas *Bombax ceiba* occurs and is important as a nectar source for birds in February and March (see plate).

#### METHODS

During the main study period (August 1976 to August 1977) I was away from the site for more than three days on just two occasions; from December 2nd to December 9th and June 2nd to June 12th. Unless the year is included all dates refer to this period.

I also use the results from two bird ringing camps organised by the Bombay Natural History Society from March to May in 1971 and 1972. The methods used in these studies were different from those I employed; many more mist nets being spread over a much wider area.

Several routine sampling operations were carried out to assess Arthropod and bird abundance. Arthropods were sampled in a number of ways. In the mature forest only a single sampling method was employed—a

branch (between six and eight metres long) of a single tree (a *Terminalia tomentosa*) was cut at approximately two month intervals and all insects remaining after it had fallen to a ground sheet below were collected. In the secondary growth area the following methods were used: (1) A weekly half hour search of a vegetation stand was conducted, aspirating all observed Arthropods able to pass down the four mm. diameter tube. (2) Two white bowls (“water traps”) containing a detergent-water mix into which insects fly were left at standard locations for 48 hours each week. (3) Two jars were sunk in the ground (pitfall traps) and emptied every two weeks. (4) Every three weeks 300 sweeps with a sweep net were made through another secondary growth area. All insects were sorted by Order and into four size classes at the Department of Zoology, Andhra University, Waltair.

Birds were sampled in two ways—through direct observation and mist netting. Each week mist nets were placed in standard sites from just above ground level to approximately two metres high. Ten nets (158 metres total length) were regularly placed in half of the secondary growth area and kept open from 1600 hours on one day until dusk the next. On another day in the week eight nets (125 metres) were placed in the other half of the secondary growth area and kept open from dawn to dusk. From the middle of March extensive clearing by nomadic tribes necessitated the amalgamation of these two days into an evening and one full day (13 nets, 211 metres). Eight nets (132 metres) were routinely placed under the forest canopy, in the second study area, although this trapping session was omitted on about six occasions through the year. Occasionally nets were placed out of the main study area in order to examine bird movements or occurrences in different habitats.



All trapped birds were weighed (to the nearest 0.1 gram if under 30 grams weight, the nearest 0.5 gram if over this weight), measured (wing length in mm), examined for state of moult and breeding, and released. Many were recaptured up to a maximum of twelve times.

Observation was conducted concordantly with the trapping, and confined almost entirely to the vicinity of the study areas. All birds recorded were entered in a daily log book. Although the intensity of coverage varied from day to day and month to month, it is felt that the average daily coverage for each month was approximately constant. A five kilometre walk, spread over three days was conducted shortly after dawn each week, recording all bird calls heard, when they could

be identified. A general impression of diets was obtained through direct observation and microscopic examination of faeces collected during trapping operations.

About eight weekends were spent away from the study area visiting villages named on the map (Figure 1), in an attempt to put the occurrence of birds at Lammasinghi in a clearer context. The village of Thajangi, seven kilometres away, at which there is a new reservoir surrounded by agricultural land, was visited about nine times during the year.

RESULTS

*Arthropod abundance*

The deciduous forest undergoes leaf drop steadily through the dry season. A qualitative impression of leaf cover changes in the ma-

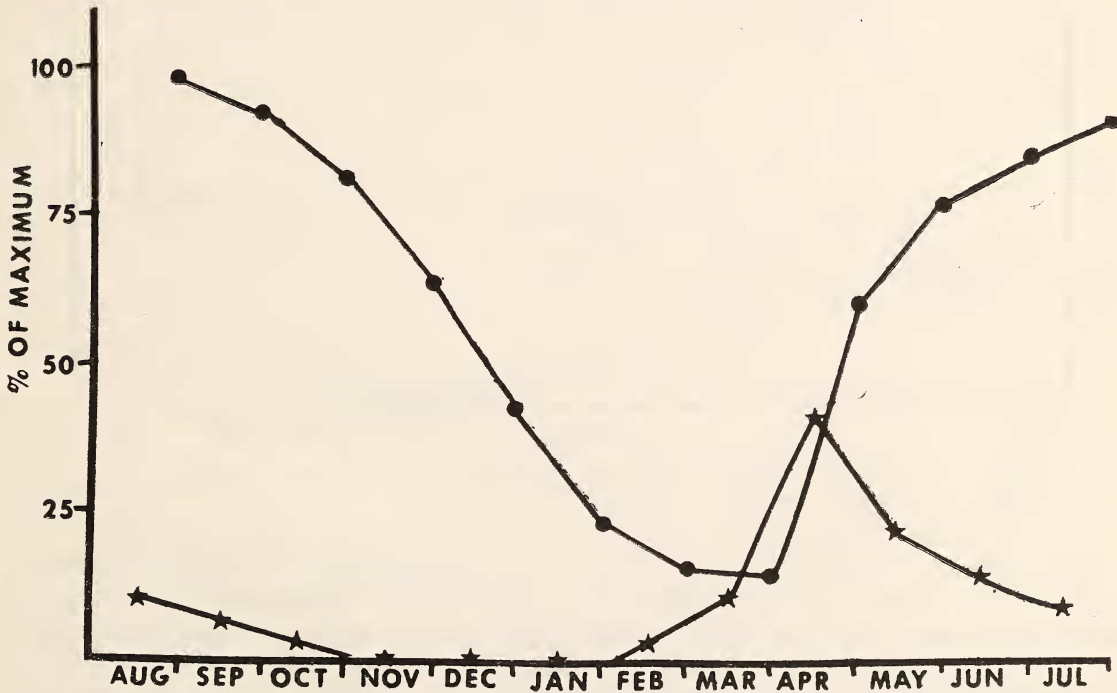


Fig. 4. A qualitative impression of leaf cover and leaf growth in the mature forest. Dots represent total leaf cover as a percentage of maximum; stars the proportion of new leaf growth in any one month.

ture forest was obtained through monthly photography and routine description of certain trees, and is presented in Figure 4. In 1977 minimal leaf cover was attained in mid March, although by then several trees had come into new leaf. Some species (e.g. *Ficus* spp., *Mangifera indica*) are evergreen; other species have an extended leafless period (e.g. *Bombax ceiba*), while most species (e.g. *Syzygium cuminii*) overlap loss of leaf with that of new leaf growth. The extent of the overlap depends on the tree species, the previous season's rainfall, and the site of the tree particularly with regard to aspect and drainage. Fluctuations in total leaf cover are considerably less in the secondary growth area and forest understory than in the mature forest canopy.

insect abundance in areas with an extended dry season concurrent with leaf loss, and in particular with lack of new leaf growth (Fogden 1972, Janzen 1973, Karr 1976a). Janzen (1973), for instance, noted a 90% decrease in Arthropod biomass through the dry season in Costa Rica.

In the secondary growth, sweep netting results (Figure 6) show an early dry season increase. Janzen (1973) noted a similar increase in Costa Rica and attributed it to migration from the more rapidly drying out forest canopy. Support for the migration hypothesis in this study comes from the observation that a large proportion of the increase was due to Diptera (Figure 6). The results from other collecting methods are detailed in Figure 7. All collection methods show significant increases

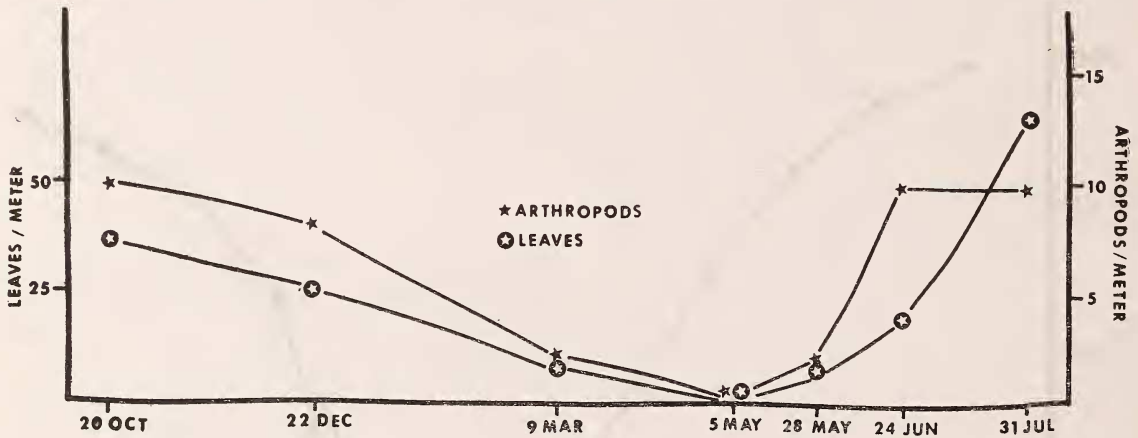


Fig. 5. Arthropods per metre and leaves per metre on individual branches cut from a *Terminalia tomentosa* tree through 1976-1977.

The number of Arthropods on the cut branch from the *Terminalia tomentosa* tree (which is one of the last tree species to lose and gain leaf in the season) correlates significantly with the number of leaves (Figure 5,  $r=0.756$ ,  $\text{°}F=5$ ,  $p<0.05$ ). Other studies in the tropics have demonstrated a decrease in

Arthropod numbers in April-May over the February-March numbers. There are biases in all collecting methods (Southwood 1966), due, among other reasons, to the variable influence of weather conditions, the inability to correct for changing leaf density, and patchiness in distribution of insects (pers. dos.). Two

further caveats suggest that wet season abundances may be relatively greater than the figures imply. The first is that the sampling is confined almost entirely to the secondary growth area, where fluctuations may be dampened with respect to the mature forest, and the observations confounded by migration. The second applies to my own inexperience in aspirating and sweep netting early in the study.

In summary, Arthropod abundance decreases continuously through the dry season, beginning to increase with late dry season flower and leaf growth, and in particular with the tremendous growth of new leaf towards the end of April, to high levels during the

monsoon season. Some Arthropods [e.g. millipedes (Diplopoda), cicadas (Homoptera) and large beetles (Coleoptera) (Figure 7: pitfalls)] disappear during the dry season, whereas the abundance of some other groups (e.g. some Hymenoptera) apparently remains relatively constant through the year.

*Bird abundance*

119 species were trapped in mist nets (table 1) and a further 35 observed in the immediate vicinity (this latter figure falls short of the true number because many of the larger non-passerines—especially birds of prey—went unidentified and are not included). A complete species list is detailed after the discussion,

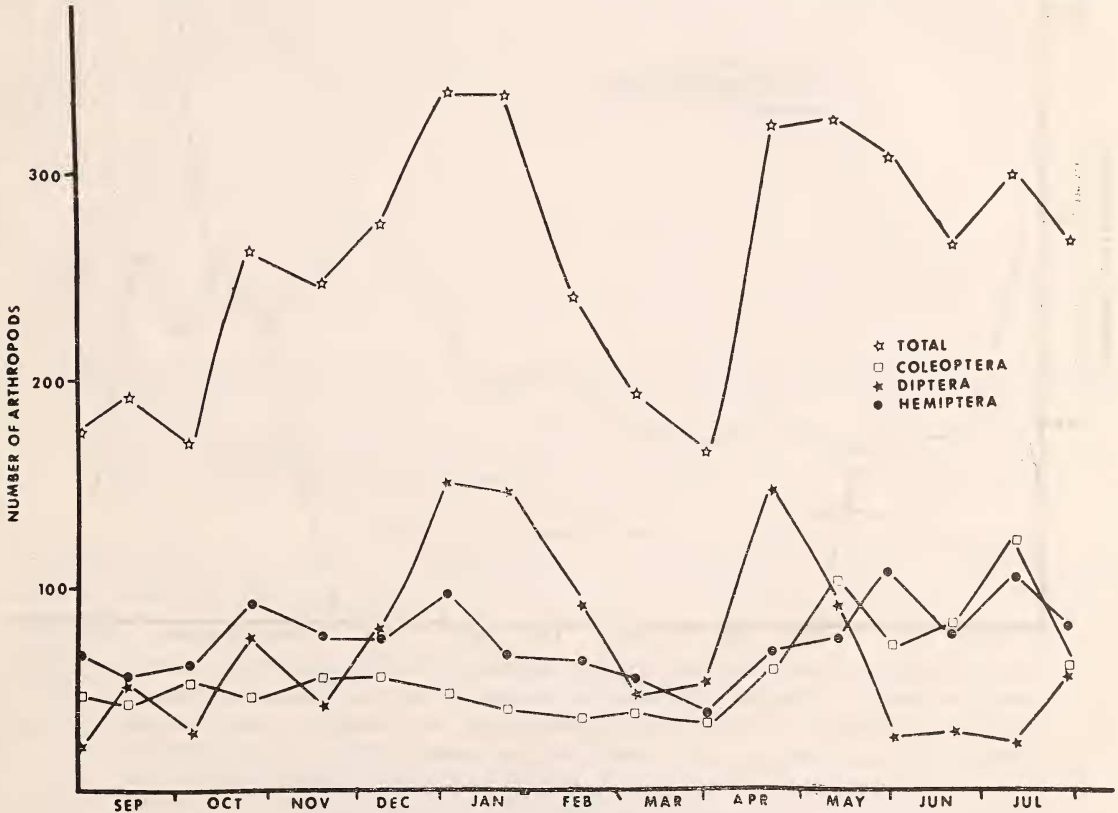


Fig. 6. Numbers of Arthropods collected in regular 300 sweeps through a stand of vegetation in the secondary growth area.

where scientific names are given.

There were 47 'standard' trapping weeks and 221 days of observation during the 1976-1977 study period. The total catch per week, grouped into three week periods, is plotted in Figure 8. The catch remains approximately constant despite changes in species composition until May, when it drops as species become more arboreal and sedentary (post-breeding—see below). Deterioration in the capture rate may also be due to birds learning to avoid nets

(see, for example, Nisbet and Medway, 1972).

The quality of the observational records increased as I became familiar with the birds and is difficult to quantify. It took up to four months to become acquainted with some of the call notes so, with the exception of the long tailed nightjar, analysis is restricted to observation only. The percentage of total days observation on which at least one individual of a given species was observed is given in table 1. There is a good correlation with the total number of individuals captured in the

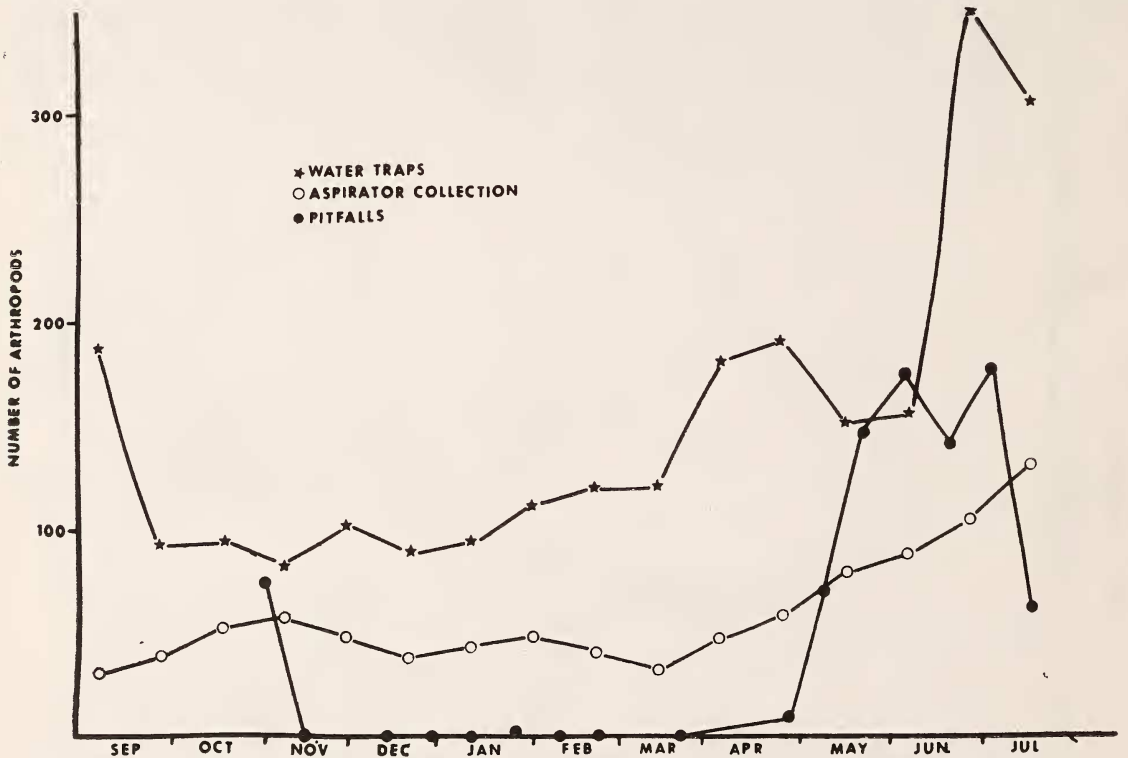


Fig. 7. Results of three Arthropod sampling methods. The pitfall traps were emptied every two weeks; the plotted point refers to the date of emptying. Because of decomposition problems only *Coleoptera* are included. Both the vegetation search with an aspirator and the placing of water traps were conducted weekly. For the purposes of the figure these were lumped into three week periods, with the plotted point at the central week. On four occasions through the year no data is available for one or other method. The collections for the three weekly period were then sealed up from the other two weeks.



45 'standard weeks' (for the commoner passerines,  $n=65$   $r=0.638$ ,  $p < 0.05$ ). The correlation is expected to be approximate because observation is biased towards larger, arboreal, species while mist nets catch the smaller, undergrowth dwelling, species. Nevertheless using the two methods in conjunction with each other can give reliable within species seasonal comparisons (see below).

sidered to be resident (see table 1) are plotted separately (Figure 9b).

*General description of the annual cycle*

Figure 10 gives, for selected species, the percentage of days observation in a month on which at least one individual of a given species was noted, and shows the seasonality in occurrence and/or observability of these species. The seasonality of species is shown also

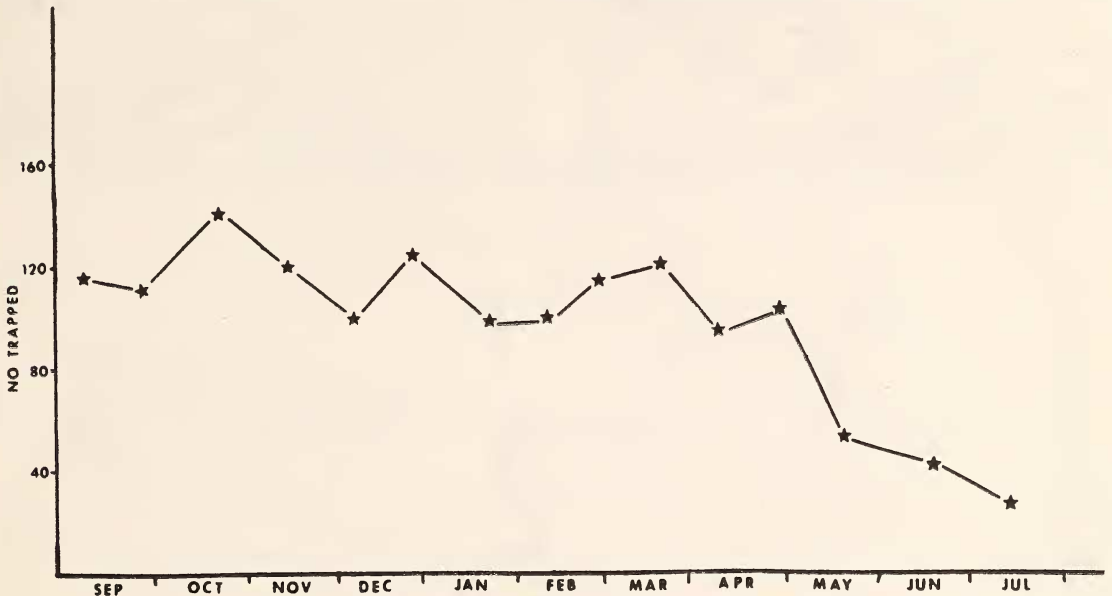


Fig. 8. Total catch in standard nets, grouped by three week periods, with the central week as the plotted point. The last point refers to two week's catch scaled up  $1\frac{1}{2}$  times. Note that the trapping effort was reduced slightly in mid March, due to habitat clearance.

Between species comparisons are more difficult to make. Considering the area and height sampled by the standard nets as a habitat in itself, still leaves biases due to differing trapability and mobility between species. The total number of individuals captured in standard nets is shown in Figure 9a and corresponds roughly with the classic species abundance log normal curve (Preston 1962). A better approximation is obtained if the 70 species con-

in capture rates through the year (table 2) and is described verbally in the systematic list. Song periods for 17 species are given in Table 3. It should be emphasized that the information is derived from the 1976-1977 study period only. During wetter years (e.g. in 1977-1978) or in wetter areas (e.g. at Gudem) song begins earlier in the season.

The breeding season can be defined using moult periods, (Snow 1976, see below),

through direct observation of birds' behaviour, the discovery of nests (both summarized in the systematic list) and the appearance of juveniles. For all but a few species (notably the wren-warblers) September, that is, the time of commencement of the study is post breeding and birds are moulting (Table 4). Some juveniles are independent (notably the White-eye), many remain associated with adults; parental care was observed in the Small Minivet and Blackspotted Yellow Tit. Bulbuls are feeding mainly on fruiting bushes in the secondary growth area. Many of the more solitary species are inconspicuous. In the mature forest large mixed feeding flocks are seen

containing up to 50 White-eyes and often the Small and Scarlet Minivets, Common Wood Shrike, Fulvousbreasted Woodpecker, Pied Flycatcher Shrike, Blacknaped Blue and Grey-headed Flycatchers and the two nuthatch species.

By mid October moult is being completed. Several species come into Autumn song and evict juveniles from territories, notably the Shama and Brook's Flycatcher (see Figure 11). Mixed feeding flocks break up and are not commonly seen through the Winter. Many small (10-15 birds) flocks of White-eyes move into the secondary growth area, and individuals from them may settle into restricted areas for

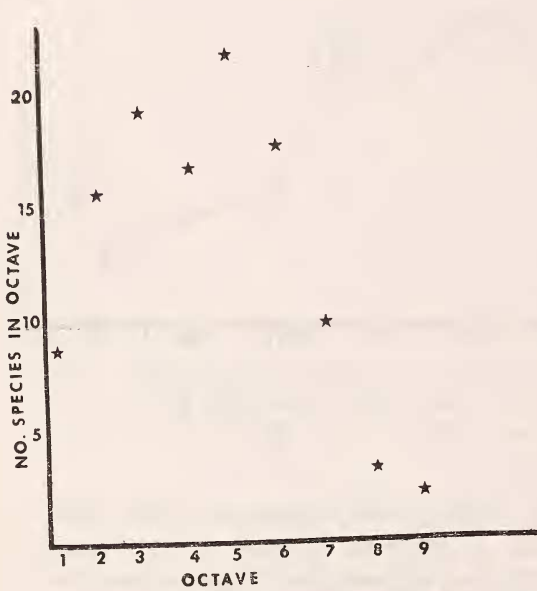


Fig. 9A

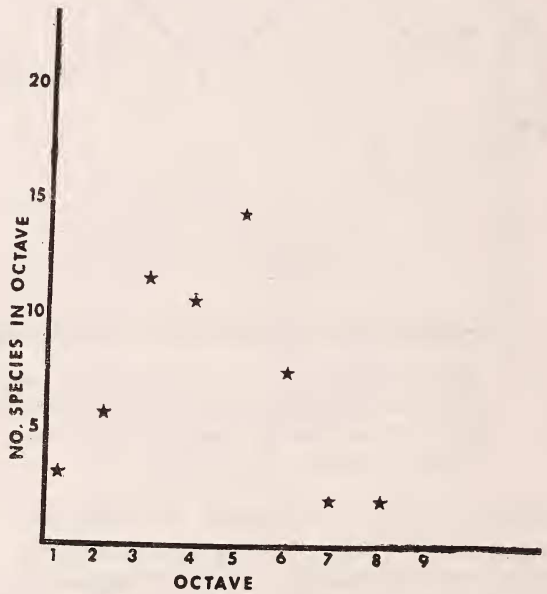


Fig. 9B

Fig. 9. Species-abundance curves. Octaves 1-9 refer to the number of captured individuals in standard nets of any one species, on a logarithmic (base 2) scale, (see Preston, 1962). Octave 1 contains 0-1 individuals, octave 2, 1-2 individuals, octave 3, 2-4 individuals, up to octave 9 (256-512 individuals). The number of species falling in the designated octave class is plotted as ordinate. Fig. 9A: For all species. Fig. 9B: For the 70 resident species only.

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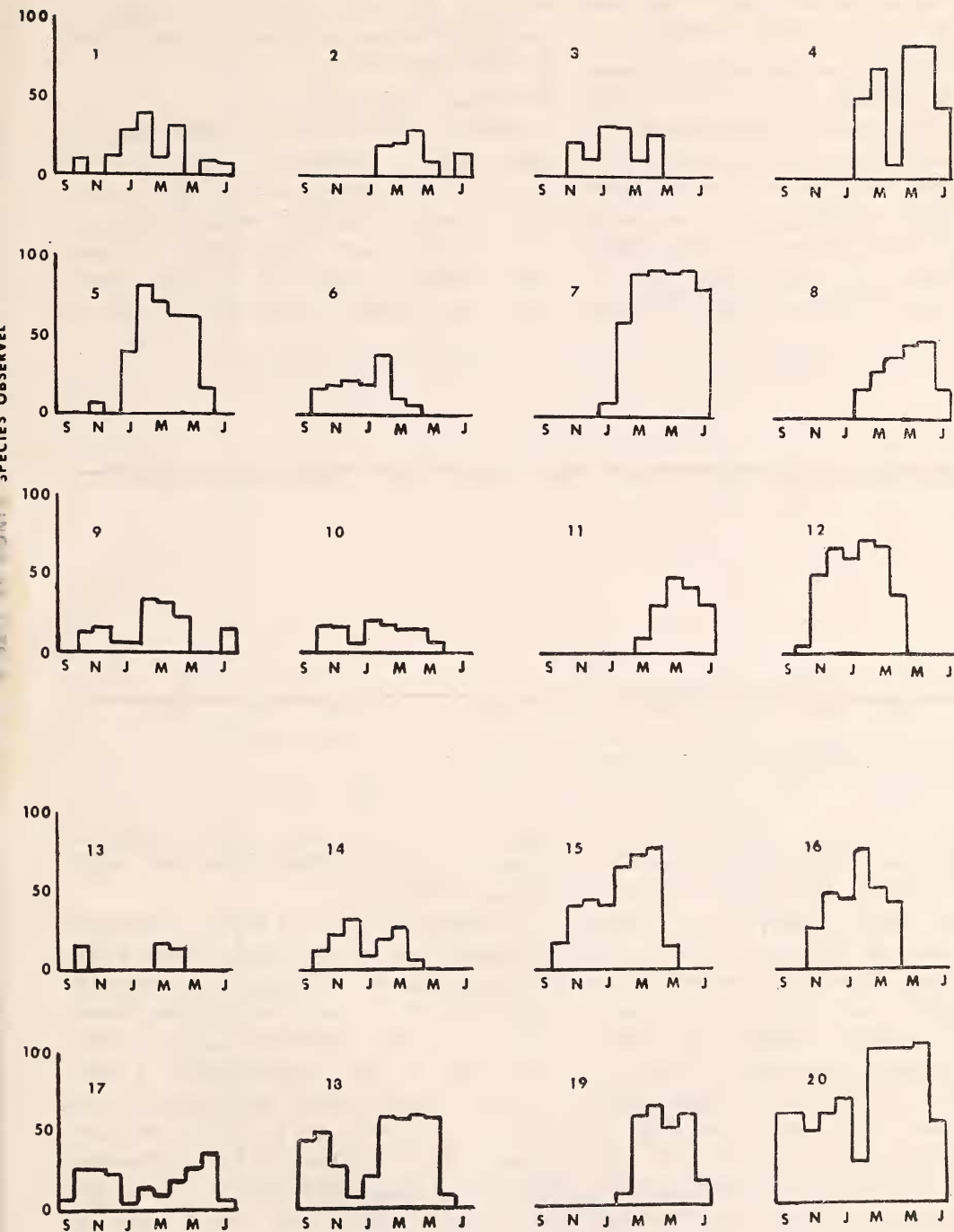


Fig. 10. The number of days in each month (from September 1976 to July 1977 inclusive) on which at least one individual of the given species was observed (except in the long-tailed nightjar which refers to number of times heard), expressed as a percentage of the total number of days observation in the month.  
 Number of days observation in each month are: September-14, October-26, December-19, January-25, February-16, March-20, April-26, May-23, June-12, July-16.  
 The species are: 1) Baybanded Cuckoo 2) Plaintive Cuckoo 3) Brown Shrike 4) Greyheaded myna 5) Hoopoe 6) Wryneck 7) Jungle Myna 8) Brahminy Myna 9) Blackheaded Cuckoo Shrike 10) Blue Chat 11) Rosy Minivet 12) Hodgson's Tree Pipit 13) Bluethroated Flycatcher 14) Rubythroat 15) Blyth's Reed Warbler 16) Common Rosefinch 17) Blacknaped Blue Flycatcher 18) Longtailed Nightjar 19) Green Pigeon 20) Magpie Robin.

the Winter. Passage migrants and Winter visitors arrive in numbers through October.

During the Winter months birds are inconspicuous and generally quite except around nectar and fruit sources. Over-wintering behaviour is detailed fully in the discussion. The first substantial rain fell on February 20th after which some breeding activity was seen. The silk cotton tree (*Bombax ceiba*) flowers from early February to mid March and attracts more than 30 species (Ali 1932), in-

mid June. By July most of the breeding is over, adults become inconspicuous and go into the postnuptial moult.

*Moult and weight data*

Because of the scarcity of weight data for Indian birds, a summary of weights is given in table 1. No attempt has been made to analyse the data for seasonal weight changes. A few individuals were noted which increased weight abruptly during the breeding season; these were probably females carrying eggs as

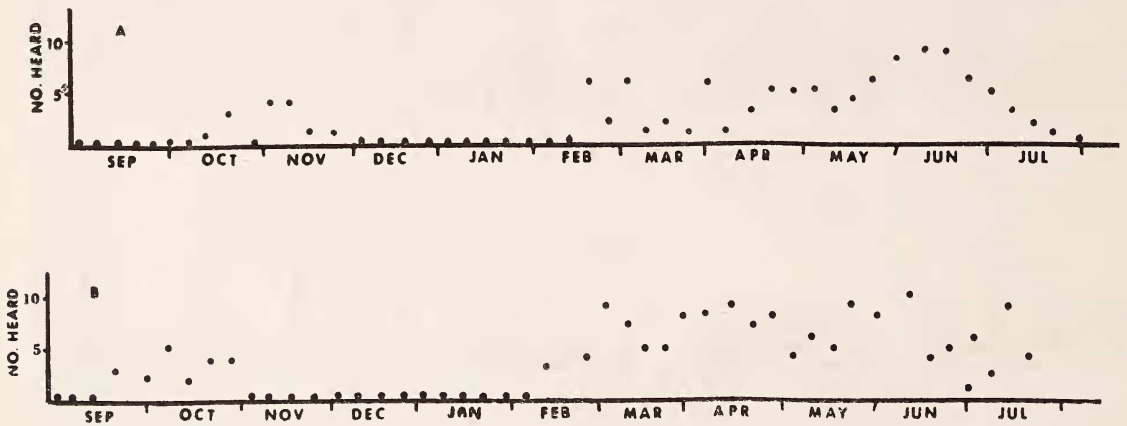


Fig. 11. The number of birds heard singing on the weekly five kilometre post-dawn walk. Fig. 11A—Shama. Fig. 11B—Brooks's Flycatcher.

cluding large numbers of two Summer visitors, the Jungle and Greyheaded Mynas. Sunbirds are in breeding plumage by February-March. Most species, however, are going through a prenuptial moult (see below) and coming into song. April is the period of maximum song, the dawn chorus is particularly loud, with the Quaker Babbler and bulbuls conspicuous. Passage migrants are present in early April, and most Winter residents depart towards the end of the month. Song dies out through May and June. Many birds still sing, but each individual does so for shorter periods. Maximal breeding is between mid April and

Fogden (1972) concluded, from a study in Sarawak and are excluded from the weight summary (table 1).

All species, as far as is known go through a complete post nuptial moult. Table 4 lists the proportion of individuals in moult for selected periods. In some cases it was known that non moulting individuals had yet to start their moult. In many species there is a complete post juvenile moult, although this could definitely be shown only for the Redwhiskered and Redvented Bulbuls and the Redfronted Babbler at Lammasinghi. Figure 13 plots right wing primary moult score against data for



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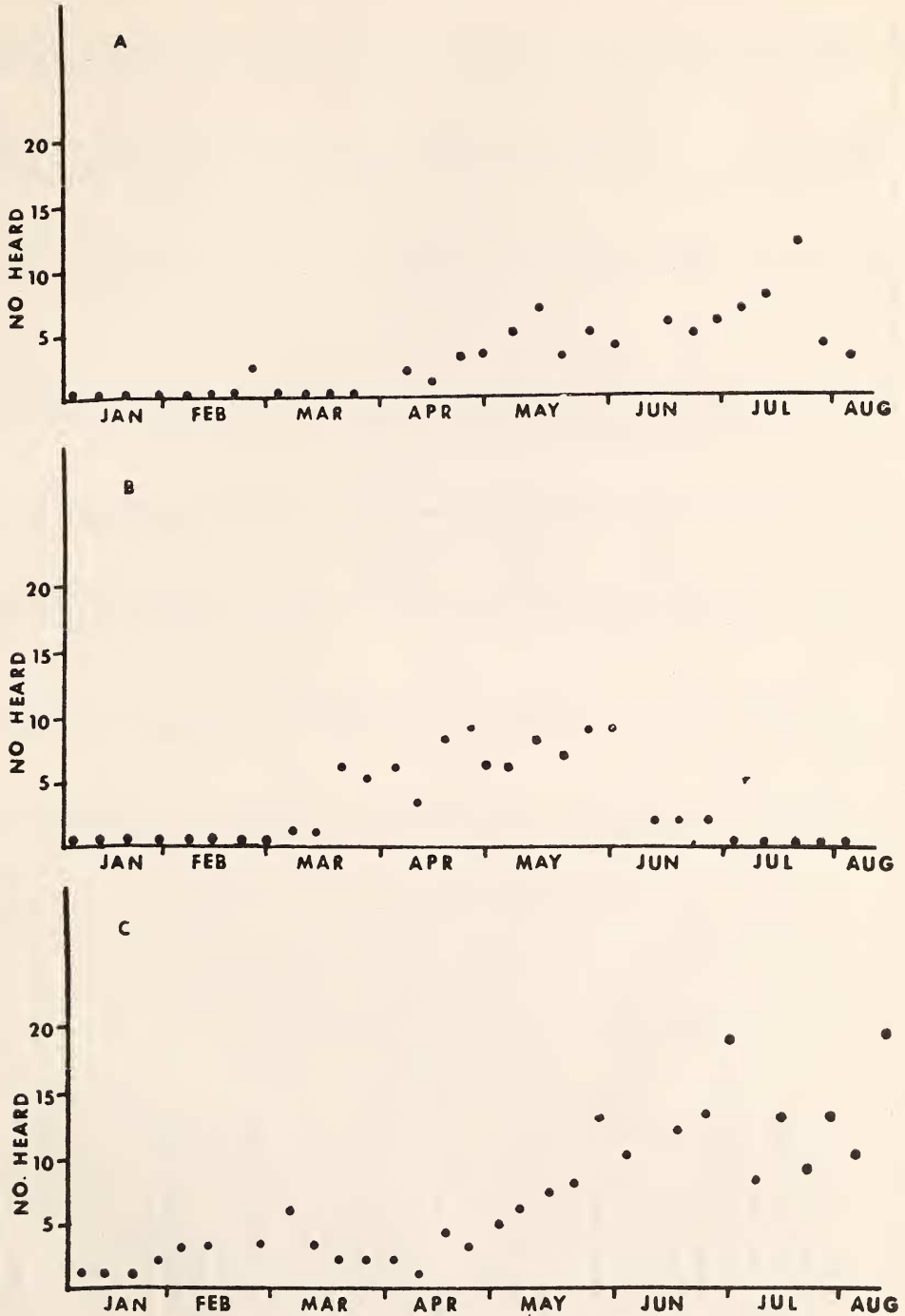


Fig. 12. The number of birds heard singing on the weekly five kilometre post dawn walk. Fig. 12A—Yellow Breasted Babbler (the “chwonk...chwonk” call (Ali and Ripley, 1971) ). Fig. 12B—Magpie Robin. Fig. 12C—Common Iora.

TABLE 1  
TRAPPING DATA

Species	Status	Total trapped	% Days observed	Habitat preference	Mean	s.e.	Weights	
							Max.	Min.
Crested Goshawk	R	1	—	—	—	—	—	—
Painted Bush Quail	R	10	—	S	56	14.1	76	38.5
Button Quail	R	8	—	S	53	9.6	70	44
Common Bustard Quail	R	3	—	S	48(2)	—	53	43
Orangebreasted Green Pigeon	S	2	22	B	175	—	194	155
Rufous Turtle Dove	W	1	2	S	207	—	—	—
Spotted Dove	R	15	99	B	106	9.8	119	96
Emerald Dove	R	13	25	F	121	11.1	158	143
Blossomheaded Parakeet	R	3	37	S	62(2)	—	65	59
Indian Lorikeet	R	1	40	B	27.4	—	—	—
Small Cuckoo	P	2	1	S	47.5	—	48	47
Baybanded Cuckoo	R	4	13	B	35.4	1.6	37.7	33.1
Plaintive Cuckoo	S	7	8	B	31.9	2.2	35.3	29.2
Koel	—	1	0	S	180	—	—	—
Large Greenbilled Malkoha	—	1	0	—	139	—	—	—
Scops Owl	—	1	—	—	70	—	—	—
Collared Scops Owl	R	2	—	—	145	—	146	143
Indian Jungle Nightjar	—	1	—	—	—	—	—	—
Longtailed Nightjar	R	2	0	S	94	—	118	70
Palm Swift	R	4	62	—	9.2	0.8	10.0	8.3
Malabar Trogon	R	3	2	F	68	4.6	73	62
Chestnutheaded Bee-eater	W	1	6	S	26.5	—	—	—
Bluebearded Bee-eater	R	4	11	B	92	4.8	97	85
Hoopoe	S	10	32	B	54(9)	7.0	62	40
Large Green Barbet	R	23	45	B	102	7.6	115	90
Coppersmith	R	11	32	B	34.5	2.4	38.3	31.6
Wryneck	W	5	12	S	33.8	2.3	37.3	30.9
Speckled Piculet	R	23	20	B	11.8	0.7	13.2	10.5
Small Yellownaped Woodpecker	R	3	10	F	67	—	75	60
Fulvousbreasted Pied Woodpecker	R	4	14	B	40.6	1.8	42.8	38.2
Pigmy Woodpecker	R	3	10	B	15.8	1.1	17.0	14.3
Indian Pitta	P	2	1	B	55	—	55.5	55
Striated Swallow	R	9	35	S	17.3	1.1	18.5	15.5
Rufousbacked Shrike	R	14	46	S	37(13)	2.8	42.5	30
Brown Shrike	P,W	16	20	S	29.7	2.1	32.8	24.6

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TABLE 1 (cont.)

Species	Status	Total trapped	% Days observed	Habitat preference	Mean	s.e.	Weights	
							Max.	Min.
Grey Drongo	R	5	53	F	43	2.4	46	39
Bronzed Drongo	—	2	4	—	23.1	—	23.8	22.4
Greyheaded Myna	S	29	36	S	38.5	1.9	41.8	35.6
Brahminy Myna	S	2	18	S	49	—	52	47
Jungle Myna	S	1	4	S	81	—	—	—
Himalayan Tree Pie	R	1	34	S	94	6.6	102	84
Pied Flycatcher Shrike	R	22	43	B	9.0	0.5	9.8	8.2
Large Wood Shrike	R	10	21	F	36.3	2.2	40	33
Common Wood Shrike	R	6	10	B	21.2	1.4	23.3	19.3
Smaller Grey Cuckoo Shrike	W	3	4	S	36.7	2.0	38.0	34.4
Blackheaded Cuckoo Shrike	R	11	12	S	29.6	2.3	32.5	26.0
Scarlet Minivet	R	6	48	B	27.7	2.5	31.5	23.4
Rosy Minivet	S	1	15	F	19.8	—	—	—
Small Minivet	R	1	38	F	9.3	—	—	—
Common Iora	R	40	60	B	14.4(38)	1.1	16.7	12.2
Goldfronted Chloropsis	R	2	18	B	34.2	—	34.8	33.7
Blackheaded Yellow Bulbul	R	9	18	F	28.0	3.3	32.1	20.2
Redwhiskered Bulbul	R	211	100	B	28.1(200)	2.4	35.3	19.6
Redvented Bulbul	R	147	100	B	32.9(135)	2.9	40.2	23.6
Whitebrowed Bulbul	R	9	5	S	33.9	3.7	37.2	31.3
Spotted Babbler	R	37	35	B	26.9(36)	1.9	30.7	22.6
Slatyheaded Scimitar Babbler	R	8	7	F	43.3(7)	1.8	44.7	41.2
Redfronted Babbler	R	24	17	B	9.2	0.2	10.4	8.2
Rufousbellied Babbler	R	40	39	S	13.0(38)	1.1	15.4	11.2
Yellowbreasted Babbler	R	28	20	F	11.6(26)	0.9	13.7	10.7
Yelloweyed Babbler	R	28	24	S	19.3(26)	1.5	21.8	15.7
Jungle Babbler	R	1	5	S	66	—	—	—
Quaker Babbler	R	57	34	B	20.7(54)	1.2	23.3	18.2
Brown Flycatcher	—	2	3	W	11.8	—	11.8	11.7
Rufostailed Flycatcher	P	1	0	—	13.1	—	—	—
Redbreasted Flycatcher	W,P	13	25	S	10.6	1.2	13.3	8.3
Whitebrowed Blue Flycatcher	W	4	9	F	7.8	0.4	8.5	7.3
Brooks's Flycatcher	R	34	34	F	15.7	1.0	16.4	14.0
Bluethroated Flycatcher	P	10	5	S	14.6	2.0	19.0	12.4
Verditer Flycatcher	W	4	11	F	17.5	0.2	17.7	17.3
Greyheaded Flycatcher	R	8	16	F	7.2	0.6	8.2	6.3
Whitebrowed Fantail Flycatcher	R	1	3	F	11.2	—	—	—

TABLE 1 (contd.)

Species	Status	Total trapped	% Days observed	Habitat preference	Mean	s.e.	Weights	
							Max.	Min.
Whitethroated Fantail Flycatcher	R	4	7	S	10.4	—	11.4	9.8
Blacknaped Blue Flycatcher	R	20	18	F	10.7	0.9	12.6	9.2
Ashy-grey Wren Warbler	R	12	13	S	6.9	1.0	8.5	5.7
Ashy Wren Warbler	R	25	27	S	7.7(23)	0.6	9.0	6.0
Jungle Wren Warbler	R	8	22	S	15.7	1.3	18.0	13.3
Tailor Bird	R	104	96	B	8.3(101)	0.7	9.8	6.9
Grasshopper Warbler	W	2	0	S	10.7	—	11.3	10.0
Thickbilled Warbler	W	4	2	S	24.7	1.5	27.0	23.4
Blyth's Reed Warbler	W	56	35	S	10.7	0.9	13.2	9.2
Tickell's Leaf Warbler	—	2	0	—	5.5	—	5.6	5.3
Yellowbrowed Leaf Warbler	W	7	7	F	5.3	0.3	5.7	4.7
Largebilled Leaf Warbler	P	10	5	F	10.4	1.3	12.2	7.7
Greenish Warbler	P,W	98	86	B	6.9(91)	0.7	8.6	5.6
Largecrowned Leaf Warbler	W	2	3	F	8.4	—	8.7	8.1
Yelloweyed Flycatcher Warbler	W	1	0	—	6.6	—	—	—
Rubythroat	W	14	11	S	20.6	1.4	22.9	18.6
Bluethroat	W	1	0	S	16.3	—	—	—
Blue Chat	P,W	24	11	B	17.1	2.0	20.4	13.0
Magpie Robin	R	27	68	B,S	33.6	2.6	37.8	29.8
Shama	R	46	50	F	28.9(43)	2.9	33.7	20.5
Pied Bush Chat	R	11	78	S	15.4(10)	1.2	17.2	13.9
Blueheaded Rock Thrush	P,W	6	5	F	34.4	2.2	38.4	31.6
Pied Ground Thrush	P	0	5	F	62	—	64	60
Orangeheaded Ground Thrush	P	5	3	F	53.5	—	62	48
Whitethroated Ground Thrush	R	32	30	B	54.5	3.0	60	50
White's Mountain Thrush	—	2	1	F	109	—	109	108
Tickell's Thrush	W	2	2	—	57.5	—	58	57
Blackbird	R	17	17	F	80(15)	4.6	80.5	65
Blackspotted Yellow Tit	R	56	81	B	16.9	1.2	19.7	14.6
Chestnutbellied Nuthatch	R	10	44	B	16.1	0.7	16.8	14.9
Velvetfronted Nuthatch	R	15	31	F	12.5	0.7	13.7	11.8
Hodgson's Tree Pipit	W	18	36	S	21.4	1.4	23.8	19.4
Forest Wagtail	P	3	5	F	17.4	1.2	19.0	16.2
Grey Wagtail	P,W	11	57	—	15.4	1.1	18.2	14.2
Thickbilled Flowerpecker	R	5	11	F	8.2	0.2	8.5	7.8
Tickell's Flowerpecker	R	42	41	B	6.0(40)	0.5	6.8	5.2



BIRDS IN THE EASTERN GHATS OF A.P.

TABLE 1 (contd.)

Purplerumped Sunbird	R	18	55	B	7.1	0.5	8.3	6.5
Purple Sunbird	R	24		B	7.3(23)	0.7	8.6	5.5
Little Spiderhunter	R	1	0		11.6	—	—	—
White-eye	R	213	96	B	8.5	0.7	10.2	6.5
Baya	—	9	6	S	24.5	1.2	26.0	23.3
Whitebacked Munia	R	40	22	S	11.8	0.9	14.7	10.0
Jerdon's Munia	R	39	28	S	14.6	1.0	16.6	12.3
Spotted Munia	R	6	11	S	13.6	0.9	15.5	11.5
Common Rosefinch	W	62	27	S	21.7(59)	1.7	18.5	25.0

Following is an explanation of column headings. *Status*. R—resident, S—Summer visitor, W—Winter visitor, P—passage migrant. *Total trapped*. Total numbers of individuals trapped in all nets in 1976-1977 and 1978. Four species trapped were not trapped in "standard" nets (see text)—the Indian Jungle Nighthjar, the Scops Owl, the Palm Swift and Tickell's Leaf Warbler. % *Days observed*: There were 221 days total observation; this column records the number of days (as a percentage) that at least one individual of the given species was seen. *Habitat preference*: the habitat in which the species is most commonly found. F—mature forest, S—secondary growth. B—both habitats. *Weights*. Mean (with sample size in brackets if different from the total trapped), standard error, and range are given.

TABLE 2

SEASONALITY IN CAPTURE AND RECAPTURE RATES FOR ALL SPECIES IN WHICH MORE THAN TEN INDIVIDUALS WERE TRAPPED. FOR EACH SPECIES THE TOP LINE GIVES THE NUMBER OF INDIVIDUALS CAPTURED IN A GIVEN PERIOD WHICH HAD NOT BEEN PREVIOUSLY CAPTURED, AND THE BOTTOM LINE THE NUMBER OF INDIVIDUALS WHICH ARE RECAPTURES FROM A PREVIOUS PERIOD. EACH INDIVIDUAL IS COUNTED ONCE PER PERIOD. AN INDEX OF "SEDENTARINESS" (SEE TEXT, % RECAPTURES, COLUMN 1) IS OBTAINED BY SUMMING THE BOTTOM LINE OVER THE 1976-1977 PERIODS AND TAKING THIS AS A PERCENTAGE OF THE SUM OF THE BOTTOM AND TOP LINES OVER THE 1976-1977 PERIODS.

Species	% Rec.	29 Aug- 3 Oct- 7 Nov- 12 Dec- 16 Jan- 20 Feb.- 27 Mar.- 1 May- 12 Jun.- 3 Jan.'78.		2 Oct. 6 Nov. 11 Dec. 15 Jan. 19 Feb. 26 Mar. 30 Apr. 4 Jun. 16 Jul. 7 Feb '78					
		4	0	3	1	2	0		
Spotted Dove	0	0	0	0	0	0	0	0	0
Hoopoe	0	0	0	1	0	2	1	0	3
Large Green Barbet	21	7	3	1	0	0	1	8	3
Coppersmith	0	0	0	0	0	1	1	1	3
Speckled Piculet	35	3	3	3	1	0	0	5	4
Rufousbacked Shrike	20	4	0	1	0	1	1	0	3
		0	0	0	1	1	0	1	0

TABLE 2 (Contd.)

Species	% Rec.	29 Aug-	3 Oct-	7 Nov-	12 Dec-	16 Jan-	20 Feb-	27 Mar-	1 May-	12 Jun-	3 Jan '78-
		2 Oct.	6 Nov.	11 Dec.	15 Jan.	19 Feb.	26 Mar.	30 Apr.	4 Jun.	16 Jul.	7 Feb '78
Brown Shrike	6	2	6	1	0	0	0	1	0	0	5
Greyheaded Myna	0	0	0	0	0	0	0	9	8	1	0
Pied Flycatcher Shrike	26	1	3	1	2	0	0	2	3	0	2
Large Wood Shrike	9	1	0	0	1	5	3	0	0	0	0
Common Iora	44	12	1	4	1	1	2	6	1	0	2
Redwhiskered Bulbul	14	57	19	17	2	2	13	27	22	17	8
Redvented Bulbul	28	23	21	19	4	7	13	8	10	7	9
Spotted Babbler	43	12	8	0	2	6	0	1	1	4	0
Redfronted Babbler	60	4	6	3	3	1	0	0	0	0	4
Rufousbellied Babbler	59	13	4	3	2	0	2	0	4	0	3
Yellowbreasted Babbler	30	3	4	1	4	10	3	5	1	1	6
Yelloweyed Babbler	34	4	3	1	0	0	2	2	1	0	2
Quaker Babbler	37	17	1	5	12	4	0	3	1	3	6
Redbreasted Flycatcher	0	0	0	0	1	0	1	7	0	0	0
Brooks's Flycatcher	42	11	15	1	1	3	2	1	0	1	3
Blacknaped Blue Flycatcher	9	0	0	6	5	2	4	1	3	1	1
Ashy Wren Warbler	43	7	2	0	0	1	1	0	0	0	0
Tailor Bird	44	31	8	6	3	2	1	4	3	0	1
Blyth's Reed Warbler	45	0	11	4	13	6	9	11	4	4	2
		0	4	8	2	1	10	12	1	0	6
		0	0	2	2	4	4	6	1	0	1



selected species. Moulting score is taken in the standard way [0 for an old feather, 1 for a feather in pin, 5 for a new feather and intermediate values for intermediate lengths, see Newton (1966)], giving a maximum of 50 points (or 45 in White-eyes and Munias) for a new wing. Relatively early moulting in sunbirds and barbets (data not presented) and late moulting in Wren-Warblers is in accordance with relative shifts in the timing of breeding.

In Spring many species undergo a partial moulting of body and tail feathers. The Quaker Babbler and Wren-Warblers undergo a second complete moulting, and the Greenish Warbler and Brown Shrike a complete premigratory moulting.

#### *Sedentariness and Distribution Between Habitats*

The proportion of birds carrying rings in any one day's trapping summed over three week periods is plotted in Figure 14 (sample sizes are given in Figure 9). The recapture rate rises steadily until the end of January, except during October, when there is increased dispersal and an influx of migrants. It then drops until mid April, associated with pre-breeding dispersal (although some movements will be due to the felling operations conducted at this time). During the breeding season birds are again sedentary. After June, juveniles in the catch decrease the recapture rate.

Some species move locally more than others. Captures in late Winter of some species may be entirely of retraps (table 2). Summing the total number of recaptures over the ten five-week "standard periods" (table 2) and taking this as a percentage of total new captures plus recaptures gives an impression of long term sedentariness in the study area. The majority of individuals were recaptured at the same net site as previously captured, or one close by. High sedentariness thus implies a territory

or home range. Small babblers had the highest recapture rate, flocks being repeatedly retrapped. Bulbuls had low recapture rates; it should be noted that this demonstrates movement in the vertical as well as horizontal dimension.

Some species are confined to mature woodland, some to secondary growth, and others to both (table 1). The large number of species in the last category to some extent reflects the close proximity of the two habitats. Elsewhere in the Ghats, in wider expanses of uniform habitat species diversity is reduced in any given habitat. Although more species of Palaearctic migrants are found in the secondary growth they are also found in numbers in mature forest [c/f observations in Africa, notably in evergreen forest (Moreau 1972, Karr 1976b)]. There are seasonal changes in use of the two habitats. Wren-Warblers and Whitebrowed Bulbuls, for instance, are occasionally found in forest clearings when it is most desiccated, during pre-breeding dispersal. Redwhiskered and Redvented Bulbuls and White-eyes are commonest in the forest during and immediately after the breeding season. Magpie Robins only occur in the forest to breed.

#### *The Occurrence of Summer Visitors*

Several species (notably the Hoopoe, Rosy Minivet, Orangebreasted Green Pigeon, Plaintive Cuckoo and the Jungle, Brahminy and Greyheaded Mynas—see table 1) are Summer visitors to the area. They all breed and it is clear (in the non-parasitic species at least) that they are arriving to exploit seasonally available food sources (mainly large insects, and fruit). This is particularly obvious in the case of the Orangebreasted Green Pigeon which feeds mainly on such trees as *Ficus tsiela* and *Bridelia tomentosa*, which fruit seasonally. The hypothesis presented is that



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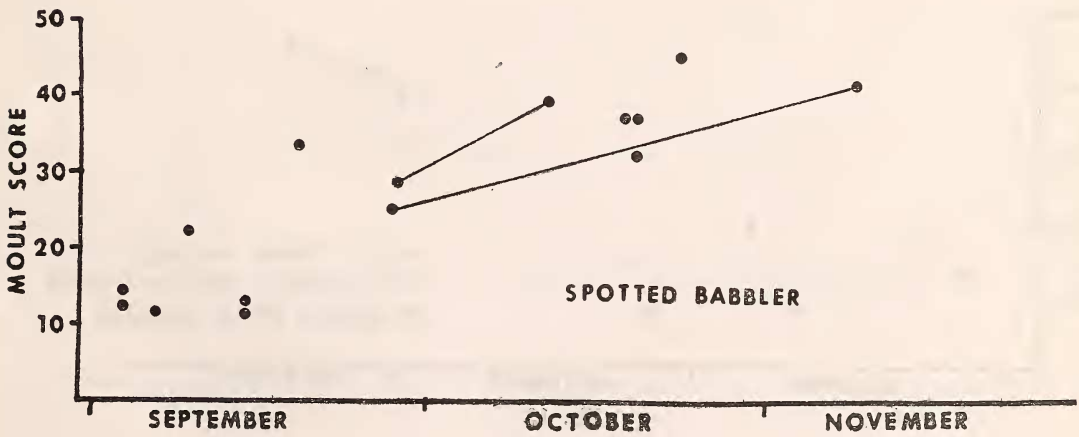
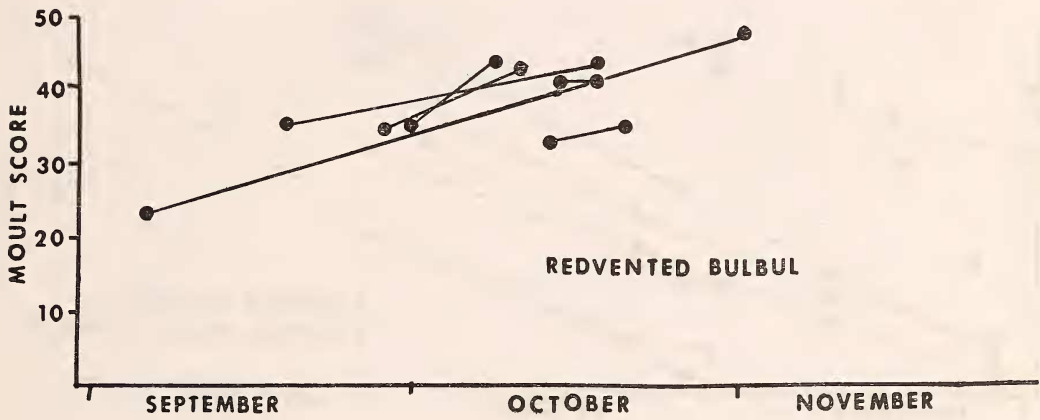
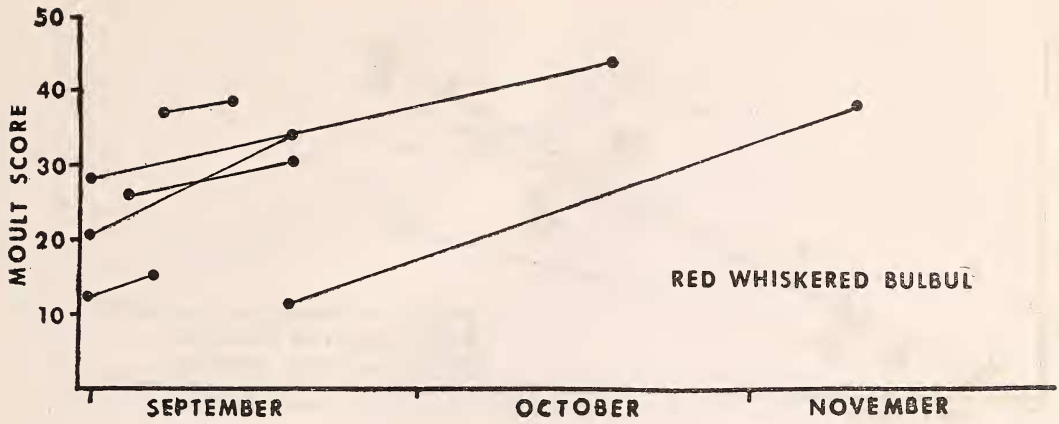


Fig. 13.

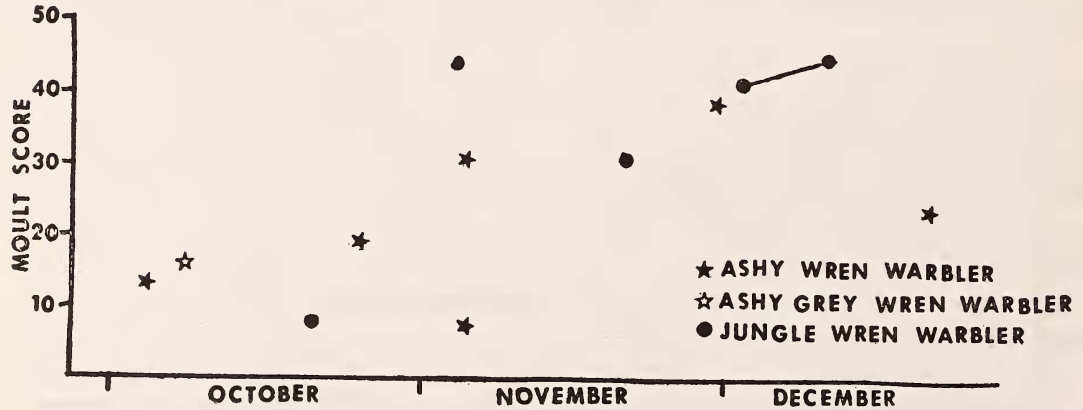
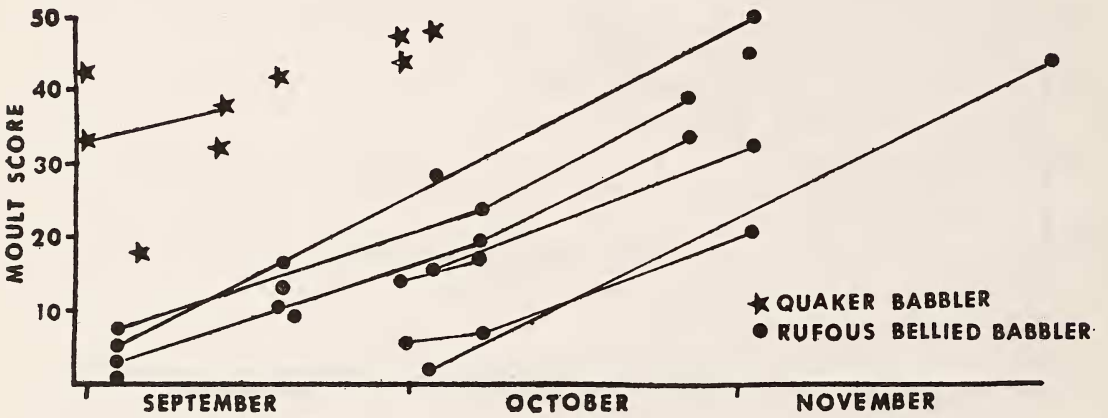
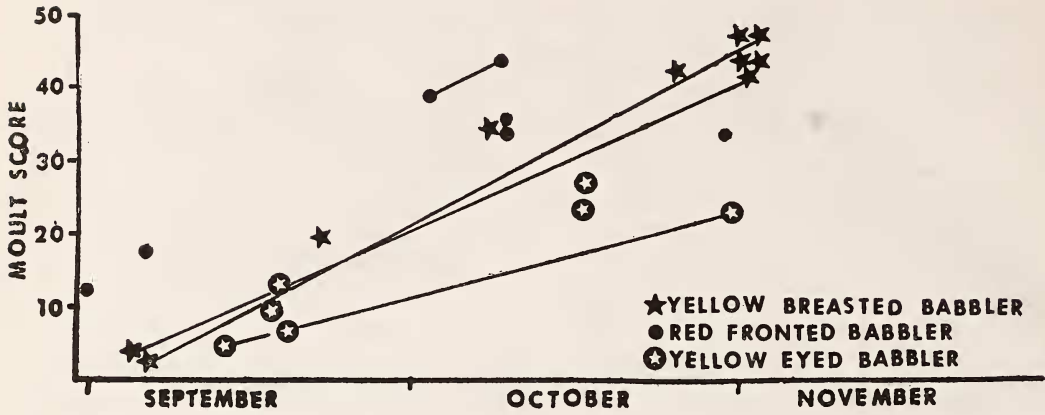


Fig. 13.

BIRDS IN THE EASTERN GHATS OF A.P.

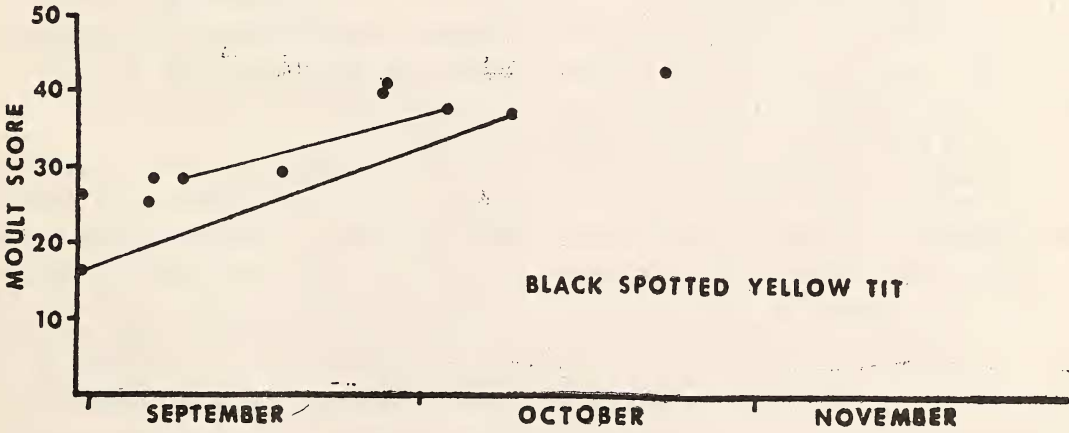
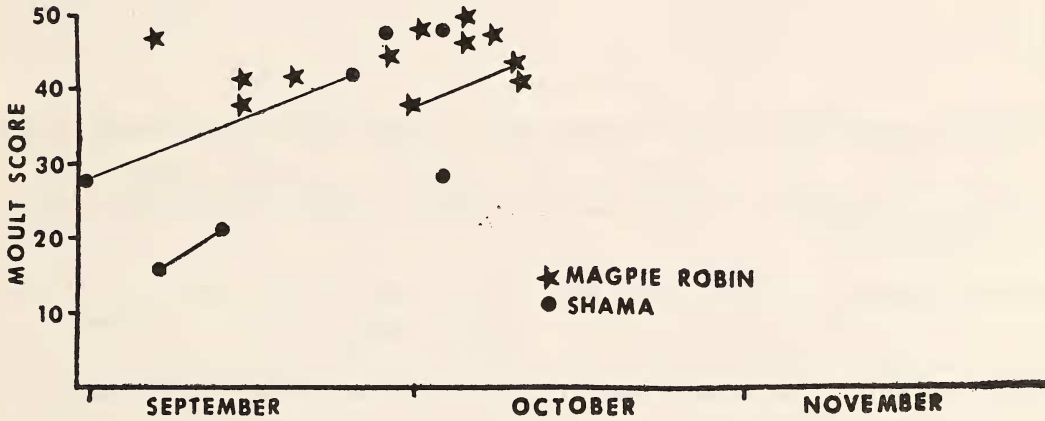
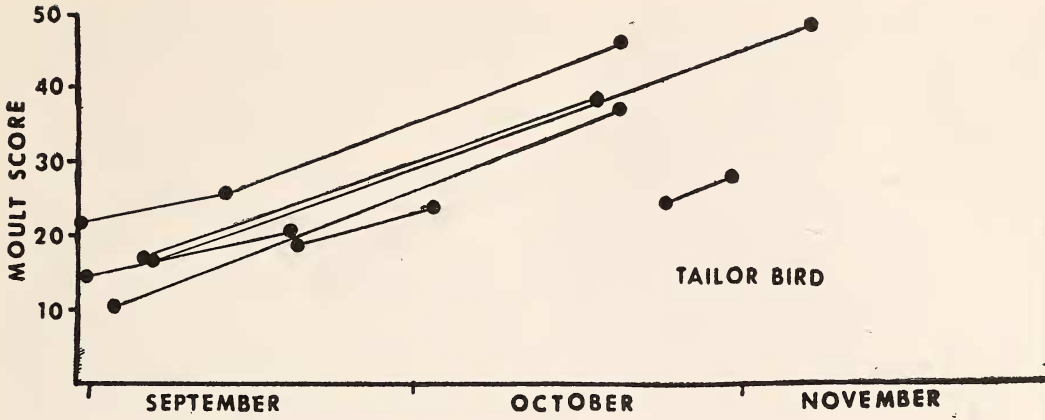


Fig. 13.

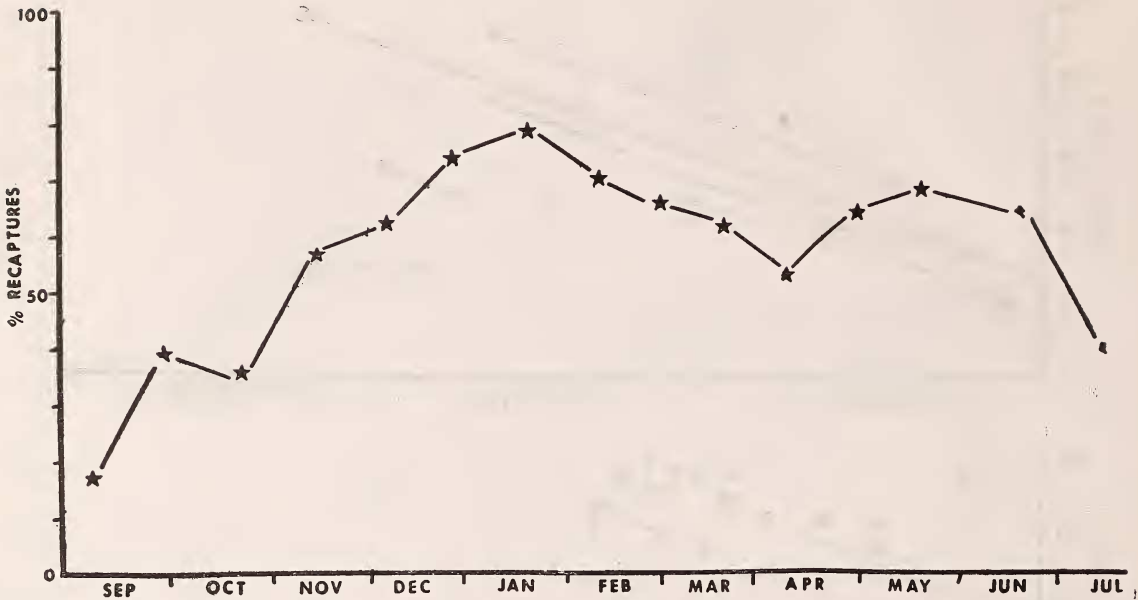


Fig. 13. Moultscore in selected species. Lines join points for the same individual. All individuals trapped are shown except for the bulbuls when only recaptured individuals are shown.

it is excluded from the occasional fruiting tree in Winter by more aggressive species (i.e. the barbets), but is well adapted for migration (c/f the barbets which appear weak flyers).

*The Occurrence of Palaearctic Migrants*

In contrast to Summer visitors the appearance of Palaearctic migrants is largely governed by changing conditions in the north temperate regions (Karr 1976b), although departure in Spring may be delayed until food levels rise in the Winter quarters. Some species are encountered only as passage migrants, others winter in the area (table 1). The proportion of Palaearctic migrants in each five week period (as a percentage of the total excluding Summer Visitors) is given in table 5. Karr (1976b), based on very small sample sizes concluded that the proportion of Palaearctic migrants in a forest at Mahableshwar (and extrapolated to cover much of India) was 50-

78%, as opposed to the 20% he found in more detailed studies in Africa and Panama. My fuller data shows his conclusion to be probably incorrect. Personal observations at Kerala and near Bombay suggest that a similar proportion of migrants occur at these localities to that at Lammasinghi, and 20% is a more accurate figure for the whole of India.

*Longevity*

It is now recognized that Passerines in the tropics have longer life expectancy at adulthood than those of temperate regions (Karr 1971, Fogden 1972, Lack 1966). While impossible to present quantitative data on this, mainly because of the wider area over which ringing teams in 1971 and 1972 worked and because birds move, it seems worthwhile to present data on all species recaptured from those camps, (table 6). The list is impressive particularly the reappearance of the Greenish

Warbler, a Palaearctic migrant and the Plain-tive Cuckoo, a Summer visitor.

#### DISCUSSION

##### Overwintering Strategies

Several lines of evidence point to the December-February period as a time of food shortage for many species. Firstly, the Arthropod collections, and qualitative observations on fruit abundance show that food levels are at their lowest during this period, as would be predicted from the climate. Fruit is seen rotting under *Ficus* trees in June, none was found under a fruiting *Ficus benghalensis* in January. Secondly, the birds themselves show no activity additional to maintenance requirements; that is, there is no moulting or breeding activity, and little song. Thirdly, there is an appreciable amount of fighting over fruit and nectar sources; this was particularly noted at a few Eucalyptus blossoms in January, intraspecifically among White-eyes and inter-specifically between the *Chloropsis* and other visiting species. It should be noted that day length is approximately one and a half hours shorter in mid Winter as compared with mid Summer, the nights are cold (Figure 3), and there are very thick, condensing, early morning fogs.

Feeding habits change in the Winter. The change for many species may be summarised in saying that there is less arboreal foraging and more time spent close to, or on the ground. I distinguish several overwintering strategies for species that are Winter residents (either permanent residents or Winter visitors).

(1) *Individual dispersal*. Individuals may vacate their breeding and/or Autumn location. The Ashy Wren-Warbler, for example, is found in forest clearings, and some species almost entirely vacate the area, presumably moving to lower elevations [e.g. the Blacknaped Blue Flycatcher (Figure 10) and

Bluebearded Bee-eater]. In two species—the Magpie Robin and Pied Bush Chat, some individuals migrate while others remain on territory throughout the Winter.

(2) *Flocking on clumped food sources*. Fruit trees have assemblage of barbets and bulbuls. Nectar sources are visited mainly by White-eyes and Lorikeets. The occasional insect outbreak, of caterpillars or flies, is exploited by bulbuls. Lantana bushes are visited by Rosefinches. With the exception of the barbets and some White-eyes all these species travel in flocks.

(3) *Territoriality*. Territories may be held by individuals, or possibly by pairs. Most of the common species showed site fidelity, individuals being repeatedly recaptured at the same net site throughout the year. Common species observed in aggressive territorial behaviour in the Autumn included the Greenish Warbler, the Blackbacked and Brown Shrikes, the Shama and the Pied Bushchat. Probably all Palaearctic migrants except the Rosefinch, the Hodgson's Tree Pipit and the Crowned Leaf Warbler are territorial. Individuals of four migrant species (the Blyth's Reed Warbler, the Greenish Warbler and the Ruby-throat, and one Twobarred Warbler) returned for the 1977-1978 Winter (table 2) to the *identical* territory of the preceding Winter, (a Hodgson's Tree Pipit also returned).

Some resident species may hold territories as pairs. White-eyes were frequently captured and recaptured in twos. Tailor Bird pairs were regularly seen feeding, and calling together.

A special study was made of territoriality in the Greenish Warbler (Price, MS). It has been shown that territories vary several-fold in size and amount of available food. The quality of the individual (that is, its likelihood of survival) correlates with this. It is probable that most Winter territoriality is to ensure an



TABLE 3

SONG PERIODS FOR SELECTED SPECIES

	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	July
Bustard Quails*											
Orangebreasted Green Pigeon											
Emerald Dove											
Baybanded Cuckoo <sup>1</sup>						?					
Plaintive Cuckoo <sup>2</sup>											
Common Iora											
Spotted Babbler <sup>3</sup>	?		?								
Yellowbreasted Babbler <sup>4</sup>											
Brooks's Flycatcher											
Whitethroated Fantail Flycatcher											
Ashy Wren Warbler	+	+	+								
Jungle Wren Warbler	+	+	+								
Magpie Robin	+	+	+								
Shama											
Pied Bush Chat											
Chestnutbellied Nuthatch											
White-eye											

— — — Song infrequent + + + song commonly heard

\* The two species of Bustard Quail are not distinguished

<sup>1</sup> The "wee tee ti tee" call (see Ali & Ripley 1969)

<sup>2</sup> The "piteer" call (see Ali & Ripley 1969)

<sup>3</sup> The "he'll beat you" call (see Ali & Ripley 1971)

<sup>4</sup> The "chwonk chwonk" call (see Ali & Ripley 1971)

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TABLE 4

THE PROPORTION OF BIRDS IN PRIMARY MOULT, AT THEIR TIME OF FIRST CAPTURE OVER THE STATED PERIOD.  
THE SAMPLE SIZE IS GIVEN IN PARENTHESES

Species	% Moulting*	Period Covered
Speckled Piculet	100(4)	30 Aug.-4 Oct.
Blackbacked Shrike	50(2)	"
Common Iora	91(11)	"
Redwhiskered Bulbul	100(57)	"
"	100(18)	20 Jul-1 Aug.
Redvented Bulbul	100(26)	30 Aug-4 Oct.
"	58(19)	1 Jun-13 Jul.
Whitebrowed Bulbul	50(2)	30 Aug-4 Oct.
Spotted Babbler	100(11)	"
Redfronted Babbler	90(10)	30 Aug-3 Nov.
Rufousbellied Babbler	88(16)	"
Yellowbreasted Babbler	100(6)	"
Yelloweyed Babbler	100(4)	30 Aug-4 Oct.
Quaker Babbler	47(17)	"
Brooks's Flycatcher	73(11)	"
Tailor Bird	62(21)	"
Blackbird	50(8)	11 Oct-31 Oct.
Blackspotted Yellow Tit	58(12)	30 Aug-4 Oct.
White-eye	90(29)	"
"	63(8)	10 Jul-27 Jul.

TABLE 5

THE NUMBER OF PALALEARCTIC MIGRANTS IN EACH FIVE WEEK PERIOD EXPRESSED AS A PERCENTAGE OF  
MIGRANTS PLUS RESIDENT

	30 Aug- 2 Oct.	3 Oct- 6 Nov.	7 Nov- 11 Dec.	12 Dec- 15 Jan.	16 Jan- 19 Feb.	20 Feb- 26 Mar.	27 Mar- 30 Apr.	1 May- 4 Jun.	12 Jun- 10 Jul.	3 Jan '78- 7 Feb '78
% Migrants	5.4	23.3	21.8	19.4	15.7	23.5	21.8	4.1	1.5	20.9
Sample Size	330	322	288	257	261	289	321	197	135	179

TABLE 6

LONGEVITY RECORDS. FIGURES IN PARENTHESES REPRESENT TOTAL NUMBERS RINGED IN THE STATED YEAR. 1971 BIRDS ARE AT LEAST 6½ YEARS OLD, 1972 BIRDS AT LEAST 5½ YEARS OLD

Species	Number recaptured during 1976-1977 from:—	
	1971	1972
Plaintive Cuckoo	0(7)	1(5)
Pied Flycatcher Shrike	1(26)	0(12)
Large Wood Shrike	0(2)	2(8)
Common Wood Shrike	1(7)	0(?)
Blackheaded Cuckoo Shrike	1(10)	0(3)
Common Iora	3(48)	2(28)
Redwhiskered Bulbul	5(?)	3(220)
Redvented Bulbul	3(74)	2(83)
Redfronted Babbler	1(?)	0(20)
Rufousbellied Babbler	2(?)	0(16)
Yellowbreasted Babbler	2(21)	0(32)
Quaker Babbler	2(60)	3(80)
Greyheaded Flycatcher	0(15)	1(14)
Blacknaped Blue Flycatcher	1(21)	0(37)
Ashy Grey Wren Warbler	1(?)	0(?)
Tailor Bird	2(97)	1(26)
Greenish Warbler	2(?)	0(?)
Shama	1(33)	1(46)
Whitethroated Ground Thrush	1(19)	2(14)
Blackspotted Yellow Tit	2(77)	0(38)
White-eye	1(121)	0(57)

TABLE 7

THE TOTAL NUMBER OF SPARROWS CAPTURED IN NETTING SESSIONS IN THE VILLAGE OF LAMMASINGHI. THE NUMBER OF JUVENILES IN THE CATCH IS GIVEN IN PARENTHESES

Species	17 Sep	12 Oct	31 Oct	23 Nov	19 Dec	9 Jan	22 Feb	22 Mar	26 Apr	22 Jun	1 Feb '78	Total
House sparrow	14(4)	12(1)	4(0)	14(3)	8(2)	8(3)	15(7)	15(5)	6(3)	16(10)	10(3)	122
Tree sparrow	3(2)	4(1)	1(0)	—	2(0)	1(0)	2(0)	3(0)	6(0)	1(1)	—	23

adequate food supply (Davies 1976, Salomonson and Balda 1976).

(4) *Permanent flocking*. Some Tits and Velvetfronted Nuthatches remain in small flocks (probably family parties) throughout the Winter. Babblers flock and are repeatedly caught in a restricted area. Two species, the Quaker Babbler and the Redfronted Babbler associate interspecifically. The Large Wood Shrike associates in flocks which wander over a large area. Probably all these species have a restricted home range or territory. Presumably it is kin which flock together, and favoured if the increased benefit gained by juveniles (in not being excluded from their natal area) is not offset by too great a loss for adults. The more omnivorous species appear to adopt this strategy, and it may be that dominance hierarchies are more efficient when feeding on fruit than insects. Flocking may also allow an extended period of parental care.

Mixed insectivorous flocks were very rarely seen during the Winter period, although occasionally seen in the wetter 1977-1978 Winter and in wetter areas, e.g. at Gudem. They are similar in composition to the large post-breeding flocks, with much reduced numbers of White-eyes. They probably form facultatively as birds vacate territories to join them. This was observed in the case of a pair of Grey-headed Flycatchers, which flew over 50 metres from the area they were normally resident in to forage with a small flock for ten minutes on the 9th January 1978. It is suggested that mixed feeding flocks are rare because many foliage gleaners are unable to maintain an insectivorous diet as Arthropod levels drop (see below).

#### **The impact of Palaearctic migrants**

Apart from the Rosefinch all Palaearctic migrants are primarily insectivorous and feed

on dispersed food sources. None were seen at clumped fruit or nectar sources, despite large assemblages of birds, including resident warblers, at the *Bombax* trees in February. In contrast to Karr's (1976a) statements directed mainly at the Neotropics, migrants do not in general exploit superabundant food sources, which simply do not exist in mid Winter. In early November large numbers of earthworms came to the surface, and formed a superabundant food. This was exploited by passage thrushes—the Orangeheaded and Pied Ground Thrushes—as well as resident thrushes (the Whitethroated Ground Thrush and Blackbird), and the Spotted Babbler.

It appears that many overwintering migrants should be in direct competition with residents. However, I postulate that seasonal changes in climate are far more important than the presence of migrants in influencing the behaviour of residents in agreement with most recent studies (see Chipley 1976, for a review).

In the case of the Greenish Warbler, the most abundant Winter visitor, it is suggested that this species is a "generalist" foliage gleaner and thus able to maintain an entirely insectivorous diet. Many of its potential competitors—the Iora, babblers, bulbuls, tits and White-eyes overlap completely with it in foraging height and habitat distribution (Price 1978), but all, with the exception of the Iora include large amounts of fruit and nectar in the diet (Ali and Ripley 1968-1974, and personal observations of foraging behaviour and faecal analysis). These are considered to be "specialist" insectivores, able to find sufficient numbers of large insects in the wet season to raise a brood, but supplementing their own diet at all times with vegetable matter. Resident warblers (the Tailor Bird and Wren-Warblers) separate from the Greenish Warbler by foraging height (they are generally con-

fined to the first two metres above ground) and take nectar. It appears possible that the Greenish Warbler is prevented from breeding by competition (although difficult to demonstrate), but unlikely that it has a significant affect on the overwinter behavior of resident species.

### Final Note

Forest destruction is having a serious impact on bird life in the Eastern Ghats. It is clear that there is insufficient habitat for the large numbers of some species of Palaearctic migrants to over winter successfully (particularly, in this study, the Greenish Warbler). Breeding populations of many forest dwelling species are being reduced, in one case (the Little Spiderhunter) to near extinction. There is, however, some influx of species from the coastal plain, as the habitat comes to resemble this area. More work is needed even to arrive at a full species list for the region. Field studies on the ecology of the tropical forest are needed so that suitable conservation projects can be proposed before all is destroyed.

### ANNOTATED LIST

All species identified on the study area at Lammasinghi are listed below, following the order of Ripley (1961). Whistler and Kinnear (1932-1939), Abdulali (1945, 1953) and Price (in press) provide notes on species occurring elsewhere on the Ghats and on the coastal plain.<sup>1</sup> An appendix lists additional species recorded within ten kilometres of Lammasinghi.

Notes are designed to give 1) an idea of the status of each species; 2) observations that differ from or are additional to, those given by Ali and Ripley (1968-1974); 3) Provide any direct evidence for time of breeding. The list should be read in conjunction with part I of

this paper, particularly with reference to tables 1 and 2 and Figures 1 and 10.

As noted previously the list is incomplete, especially with respect to the larger non passerines, to which I paid little attention.

Paddy bird. **Ardeola grayii**.

Occasionally seen, especially between December and February on the paddy.

Blacknecked stork. **Xenorhynchus asiaticus**.

One or two birds occasionally seen in January and February.

Blackwinged kite. **Elanus caeruleus**.

Resident.

Pariah kite. **Milvus migrans**.

One or two birds regularly seen over the village through the year.

Shikra. **Accipiter badius**.

Noted between January and July.

Crested goshawk. **Accipiter trivirgatus**.

Resident, noted in display flights in March.

Crested serpent eagle. **Spilornis cheela**.

Regularly seen and heard.

Black eagle. **Ictinaetus malayensis**.

Regularly seen.

Kestrel. **Falco tinnunculus**.

One on the 11th April, also elsewhere, e.g. at Solabum on the 15th January.

Painted bush quail. **Pedicularia erythorhyncha**.

Resident. Two adults with four juveniles captured on the 25th January. The juveniles were going through wing moult.

Red spurfowl. **Galloperdix spadicea**.

Common resident.

Red junglefowl. **Gallus gallus**. Common resident.

Indian peafowl. **Pavo cristatus**.

Seen or heard on three occasions at Lammasinghi where it has been mostly short out. Commoner around Merripakala.



Button quail. **Turnix tanki**.

Common bustard quail. **Turnix suscitator**. Both *Turnix* species are common in the area. See song chart.

Redwattled lapwing. **Vanellus indicus**.

Occasionally seen in January and February; breeds further west on the plateau.

Orangebreasted green pigeon. **Treron bicincta**.

Summer visitor, recorded between the 2nd February and the 13th July. (Figure 10). In 1978 a few birds present in January. Flocks arrive and are common from mid March to mid April on fruiting trees, after which there is dispersal for breeding. A captured bird laid an egg on the 2nd May.

Rufous turtle dove. **Streptopelia orientalis**. Up to four individuals recorded at Lamma-singhi between December and February. More common elsewhere in the Ghats, e.g. at Gudem, where it probably breeds.

Spotted dove. **Streptopelia chinensis**.

Resident; courtship, fighting and song most pronounced between June and September. Up to fifty birds flocking on stubble in the Winter months.

Emerald dove. **Chalcophaps indica**.

Resident, commoner in the wetter forests between Gudem and Merripakala.

Blossomheaded parakeet. **Psittacula cyanocephala**.

Parties of up to six birds regularly seen throughout the year. Larger parties recorded further west on the more open areas, e.g. around Chintapalli.

Indian lorikeet. **Loriculus vernalis**.

Common resident in the area, up to 40 birds noted at Eucalyptus blossoms during January.

Indian cuckoo. **Cuculus micropterus**.

Single birds heard calling at dawn on the 19th

April and 4th May.

Cuckoo. **Cuculus canorus**.

Heard on most days during May. Two birds were seen being mobbed on the 19th May by bulbuls and white-eyes. The species must breed in the area (see also Neavoll 1968).

Small cuckoo. **Cuculus poliocephalus**.

Recorded on passage four times in October. One was also captured on the 5th May 1971.

Baybanded cuckoo. **Cacomantis sonneratii**.

Probably resident, although inconspicuous and silent between November and January. There are two distinct calls—a rising crescendo “pi pi pee... pi pi pee” as described for the Plaintive Cuckoo by Ali and Ripley (1969), and the four noted whistle “wee tee ti tee”. The rising crescendo, identical to that given by the Plaintive Cuckoo is heard from January right through to October, most commonly between March and May. The “wee tee ti tee” was first heard on the 7th February, and was given late into the night in April, having died out by mid June. See Figure 10.

Plaintive cuckoo. **Cacomantis merulinus**.

Summer visitor, first record on the 25th February (Figure 10). The “piteer” call first heard at the beginning of April, commonly between April and June. On the 7th July a juvenile was trapped. The rufous phase is fairly common. The Plaintive Cuckoo is commoner than the Baybanded cuckoo during the breeding season. The relationship between the two species, in view of one of their songs being identical deserves further study. A between-species chase was noted in early April.

Koel. **Eudynamys scolopacea**.

A female captured on the 25th October and heard several times during March and April. Very common on the coastal plain.

Large greenbilled malkoha. **Rhopodytes tristis.**

A single bird trapped on the 25th January 1978, although there are several unconfirmed sight records for January and February 1977. A range extension for the species.

Crow pheasant. **Centropus sinensis.**

Regularly heard from January onwards. Resident.

Scops owl. **Otus scops.**

A single bird trapped on the 24th January, the only record for Lammasinghi.

Collared scops owl. **Otus bakkamoena.**

Probably resident.

Indian jungle nightjar. **Caprimulgus indicus.**

A single bird captured on the 21st January 1978, the only record. Common on the coastal plain.

Longtailed nightjar. **Caprimulgus macrurus.**

Resident, one bird captured in July, recaptured the following January. See also Figure 10.

House swift. **Apus affinis.**

200 passed over the village on the 26th May. Breeds commonly elsewhere, e.g. at Sileru.

Palm swift. **Cypsiurus parvus.**

Throughout the Winter season thousands undertake a daily migration from roosts in Palm trees on the coastal plain. This migration noted low over Lammasinghi in the mornings in September and in the evenings between January and March. One count on February 1st totalled 8,500 passing over between 1615 and 1730 hours. Between April and June small flocks were occasionally seen fleeing storms. Several pairs probably bred in the area.

Crested tree swift. **Hemiprocne longipennis.**

Resident, a maximum of 34 birds seen circling overhead in September.

Malabar trogon. **Harpactes fasciatus.**

Resident in the mature forest throughout the Ghats area.

Whitebreasted kingfisher. **Halcyon smyrnensis.**

Seen on about ten occasions through the year above the paddy.

Chestnut-headed bee-eater. **Merops leschenaulti.**

Up to eight birds seen from the 12th January through February. Last record on the 23rd March. An extension of the wintering range: recorded also in January 1978.

Small green bee-eater. **Merops orientalis.**

Singles and a small party seen in mid-October, (when the bird was abundant on the coastal plain at the foot of the Ghats) and at the end of March.

Bluebearded bee-eater. **Nyctyornis athertoni.**

Conspicuous and noisy between April and August. Rare in January and February when birds probably moved to lower elevations.

Hoopoe. **Upupa epops.**

Mainly a summer visitor, though one noted on the 1st November. Influx in January, some song from February onwards, notable during April. Two nests with young discovered in the last week of April, and a juvenile captured on the 9th May. No birds present after mid June. (Figure 10).

Indian pied hornbill. **Anthracoceros malabarius.**

A pair heard and seen during March-April. Fairly common in the Gudem—Merripakala region.

Large green barbet. **Megalaima zeylanica.**

Common resident.

Coppersmith. **Megalaima haemacephala.**

Common resident. Individuals of both species of barbet captured in April with well developed brood patches.

Wryneck. **Jynx torquilla.**

Recorded between the 7th October and the 7th April. Two birds regularly recaptured through this period.

Speckled piculet. **Picumnus innominatus.**

Regularly seen; a family party captured on the 25th April.

Rufous woodpecker. **Micropternus brachyurus.**

Occasionally seen between January and July.

Large yellownaped woodpecker. **Picus flavinucha.**

Not recorded during the study period. An individual was trapped in March, 1971 and the species has been recorded elsewhere in the Ghats (Hussain *et al.* 1976).

Lesser yellownaped woodpecker. **Picus cholorophus.**

Occasionally seen between January and July, regularly heard calling from mid February onwards.

Fulvousbreasted woodpecker. **Picoides macei.**

Regularly seen; on the 5th July a juvenile being fed by a female.

Yellowfronted pied woodpecker. **Picoides mah-rattensis.**

Seen on about six occasions during the year, moving into the area notably towards the end of the dry season. Commoner in open woodland further west on the plateau.

Pygmy woodpecker. **Picoides nanus.**

Regularly seen. Larger goldenbacked woodpecker. **Chrysocolaptes lucidus.**

Two or three pairs regularly seen and heard through the year. One pair at nesting hole on the 26th May.

Indian pitta. **Pitta brachyura.**

Three passage records only: the 2nd and 19th October and the 25th April.

Redrumped swallow. **Hirundo daurica.**

Seen in flocks of up to 100 during the Winter, often associated with the Palm Swift. Immediately after the first rains, on the 26th February, a pair began nest building, but they had not bred by mid April. Eight caught on the 5th February 1978 were all in primary moult.

Baybacked shrike. **Lanius vittatus.**

A single bird seen on the 22nd of February. Common on the coastal plain; not recorded elsewhere in the Ghats, (but see Whistler and Kinnear 1933).

Rufousbacked shrike. **Lanius schach tricolor.**

Resident, singing only noted between December and February. Juveniles first noted in early July. Two of the individuals trapped had grey "erythronotus" feathers admixed in the crown and back.

Brown shrike. **Lanius cristatus.**

An adult trapped on the 22nd September. The main arrival, entirely of juveniles was in the first two weeks of October, and territories were established. Conspicuous until the middle of November when birds virtually disappeared. Because of the changed foraging habit (from typical shrike like exposed perching to feeding within undergrowth) it is not clear how much, if any, of this disappearance was due to dispersion. A return passage noted in the last two weeks of April; all birds in freshly moulted plumage. In January 1978 more birds were present on the study area than in January 1977: Elsewhere on the plateau in January 1978, two adults were seen.

Golden oriole. **Oriolus oriolus.**

Two on the 22nd March, the only ones observed. Common on the coastal plain.

Blackheaded oriole. **Oriolus xanthornus.**

First noted in association with *Bombax* blossoms in mid February. A pair regularly seen



and heard during the following six months of the year. Common resident in the wetter forest areas, e.g. near Gudem, and observed at Lammasinghi in January 1978.

Grey drongo. **Dicrurus leucophaeus.**

Clearly a resident in the area. Particularly conspicuous around *Bombax* trees in February and March. One pair occupying a large mango tree in the secondary growth area was seen chasing Jungle Crows and Crow Pheasants between the 15th May and the 24th June. On the 24th May a bird was seen carrying a faecal sac from the tree, and on the 2nd June a free flying juvenile noted. One individual captured on the 1st October was going through wing moult.

Whitebellied drongo. **Dicrurus caerulescens.**

Two on the 14th January and one on the 12th January, 1978. Commoner on the coastal plain.

Bronzed drongo. **Dicrurus aeneus.**

Resident in the Ghats, especially common in the wetter forests, e.g. from Gudem to Merripakala. Occasionally recorded at Lammasinghi.

Ashy swallow shrike. **Artamus fuscus.**

Recorded on the 27th November and the 22nd December only. Breeds at Thajangi Lake, and common on the coastal plain.

Greyheaded myna. **Sturnus malabaricus.**

First recorded in mid February; subsequently flocks of up to 100 birds seen going to roost. Dispersal for breeding during March. A few pairs bred in the area between April and May. Small flocks seen between June and July, by the end of which birds had disappeared. (Figure 10).

Brahminy myna. **Sturnus pagodarum.**

The common *Sturnus* of the coastal plain. One or two pairs arrived with the grey headed

myna and bred in the area. Noted singing in April, and with young in the nest on the 31st May. (Figure 10).

Pied myna. **Sturnus contra.**

Seen occasionally in January and February at Lammasinghi; this species is fairly common in the dry arable areas of the plateau.

Common myna. **Acridotheres tristis.**

Rarely seen at Lammasinghi between January and March. Common on the coastal plain and on drier areas of the plateau to the west.

Jungle myna. **Acridotheres fuscus.**

Occasionally seen throughout the year. Numbers increase from January, and birds were regularly seen in March and April. Young in the nest on the 31st May. Decrease through July. (Figure 10).

Hill myna. **Gracula religiosa.**

Regularly seen in the mature forest; commoner in the evergreen forest around Merripakala.

Himalayan tree pie. **Dendrocitta formosae.**

Resident, particularly conspicuous in September and after July when groups of birds go noisily to roost.

Jungle crow. **Corvus macrorhynchos.**

Birds seen going to roost down the ghatface regularly from September to January (182 maximum recorded on the 14th September). Only 54 noted in mid January, when some birds were roosting on the plateau. Birds in display flight in March; food being carried to young in the nest on the 5th April. Family parties seen from May 5th to the end of June, after which they break up.

Pied flycatcher-shrike. **Hemipus picatus.**

Resident.

Large wood shrike. **Tephrodornis gularis.**

Regularly but infrequently seen in parties of up to seven birds in the Winter months (up to

10 after breeding). It is apparent that these flocks wander over a large area; one individual was captured in nets two kilometres distant, in separate months.

Common wood shrike. **Tephrodornis pondicerianus.**

Single birds infrequently seen in secondary growth area, or in the company of mixed feeding flocks in the deciduous woodland. Two seen chasing and displaying on the 9th March.

Large cuckoo-shrike. **Coracina novaehollandiae.**

Only seen on three occasions through the study period. Two individuals trapped in March, 1972. The species is commoner elsewhere, e.g. between Thajangi and Bussalkert.

Dark grey cuckoo-shrike. **Coracina melaschistos.**

An uncommon Winter visitor to the area, occasionally recorded between December 20th and March 22nd. In January, 1978 one bird noted chasing a female Blackheaded cuckoo shrike.

Blackheaded cuckoo shrike. **Coracina melanoptera.**

Although clearly a resident in the Ghats (Figure 10), captures at Lammasinghi were confined to October and November and March and April. Of the nine birds trapped, eight were males. No birds seen in May and June although males were singing near Down-eru at the foot of the Ghats on the 31st April. During July two or three males were present and singing.

Scarlet minivet. **Pericrocotus flammeus.**

Display flights seen from February to May, with males chasing each other and females. One nest was being built at the end of May by the male alone during 90 minutes of observation.

Rosy Minivet. **Pericrocotus roseus.**

Summer visitor. First arrival on the 2nd March. Fairly common during April to June and clearly bred in the area (Figure 10). Post breeding birds are often associated in flocks with the Small Minivet: One premigratory flock of over 8 birds seen on the 20th July. Two males were seen on the 23rd January 1978. See Figure 10.

Small minivet. **Pericrocotus cinnamomeus.** Flocks of up to six birds commonly seen throughout the year.

Common iora. **Aegithina tiphia.**

Common, but widely dispersed and inconspicuous during the mid Winter months. In the mature forest it remains in the canopy and was never captured. First bird in full breeding plumage was noted on the 7th March. The "see me please" song is first heard at the end of January (see Figure 12). Many second year birds did not come into full breeding plumage: males captured on the 29th May and 14th June had only the central tail feathers replaced. It is not known if they bred. One nest with young on the 2nd June, another being built on the 29th May.

Goldfronted chloropsis. **Chloropsis aurifrons.** Regularly seen, notably vociferous around nectar sources in the Winter months. The call note of several individuals in this area is identical to that of the Grey Drongo. Song noted in September and between March and July included imitations of the Scarlet Minivet, Blacknaped Blue Flycatcher (call note), Red-whiskered Bulbul and Large Wood Shrike. On the 6th July a bird was captured with a well developed brood patch.

Blackheaded yellow bulbul. **Pycnonotus melanicterus.**

Common throughout the mature forests, particularly in the wetter areas, e.g. near Gudem.



One bird captured on the 13th October had flecks of ruby red on the breast—identical coloration to the red throat of the subspecies *guiaris* of the south Indian hills.

Redwhiskered bulbul. ***Pycnonotus jocosus***. Abundant, building observed from March to May, first juveniles noted in early May.

Redvented bulbul. ***Pycnonotus cafer***. Abundant, eggs noted from mid April to the end of June. Particularly noisy in the April dawn chorus.

Whitebrowed bulbul. ***Pycnonotus luteolus***. Resident in small numbers in secondary growth, commoner on the plains. Song noted from at least early January.

Spotted babbler. ***Pellorneum ruficeps***. Resident, in pairs and small parties. The “he’ll beat you” call of Ali and Ripley common in April and May, allows contact over at least 200 metres. A trapped bird had a well developed brood patch on the 25th April.

Scimitar babbler. ***Pomatorhinus schisticeps***. Regularly heard through the year. A bird captured on the 25th March, 1972 laid an egg in the hand.

Redfronted babbler. ***Stachyris rufifrons***. Calling throughout the year particularly during April and May. Often associated with Quaker Babblers.

Rufousbellied babbler. ***Dumetia hyperythra***. Seen in parties of up to 11 birds from September to March, although inconspicuous from January—March. On the 20th July two nests were discovered within 20 metres of each other, and may have been from pairs splitting from the same party. At this time post breeding groups were seen elsewhere.

Yellowbreasted babbler. ***Macronous gularis***. More arboreal than the other small babblers, seen in small parties or singly. The call note

is heard throughout the year, particularly from April to July (Figure 12). Young fledged from a nest on the 13th July. The commonest babbler in the thick forest at Merripakala.

Yelloweyed babbler. ***Chrysomma sinense***. Regularly seen in the secondary growth area; commoner in Lantana especially elsewhere in the plateau.

Jungle babbler. ***Turdoides striatus***. Sisterhoods only seen between the 11th January and the 2nd February. Apparently bred in the area—individuals were recorded from February to August, sentinel ‘checking’ noted in April, and a juvenile seen in May. Commoner elsewhere in the plateau.

Quaker babbler. ***Alcippe poiocephala***. Common in pairs or small flocks often associated with *Stachyris* or *Macronous*. The song recorded by Ali and Ripley (loc. cit.): “a quavering trill of four notes” is heard throughout the year, and is the most prominent song of the April dawn chorus. In addition there is an unrecorded song, consisting of similar quality (but many more) notes uttered in a long down cadence accompanied by chattering from the female. Nest building was observed in the last two weeks of May and also in early July. In May some birds were still going through the complete prenuptial moult. Of interest is the record of two birds trapped on the 11th April 1971 and recaptured together three times during the study period.

Brown flycatcher. ***Muscicapa latirostris***. A pair seen first on the 31st March, and seen on subsequent weeks in April chasing each other through the tree tops. Individuals captured on the 20th and 27th of April. Although not seen after this they may well have bred in the area. A single bird noted on the 13th July.

Rufoustailed flycatcher. **Muscicapa ruficauda.**  
A single passage record of a bird trapped on the 4th April.

Redbreasted flycatcher. **Muscicapa parva.**  
Widespread Winter visitor in fairly small numbers. Recorded between the 18th October and the 16th April. Notable passage in the last week of March and first two weeks of April; several males were trapped in full breeding plumage.

Whitebrowed blue flycatcher. **Muscicapa supercilialis.**

Widespread but sparingly distributed Winter visitor to the whole of the Ghats area. First noted in the first week of November, last recorded on the 29th March. Males (both subadult and adult) are more common, and easily identified by the "whi churr" call note. The only female noted was one trapped on the 16th December. Adult males observed, and one trapped, had no white in the tail, and a very thin white supercilium, placing them close to the subspecies *aestigma* (Whistler and Kinnear 1933).

Brooks's flycatcher. **Muscicapa poliogenys vernayi.**

A common resident. Whistler and Kinnear (1933) identified this species as *poliogenys* (c/s *Muscicapa tickelliae*) because of the brown juvenile plumage and dull female, and measurements support this. However adult males are very blue, and the song closely resembles that of the Tickell's Flycatcher heard in Borivli National Park near Bombay. The situation needs further investigation. There is clearly only one species present here, and for the present the range of Tickell's Blue Flycatcher should be adjusted accordingly. Territorial behaviour and song noted in both early Autumn and in April and May (see Figure 11B). Both male and female were sing-

ing around recently fledged young as I approached on the 1st June.

Bluethroated flycatcher. **Muscicapa rubeculoides.**

A passage migrant, recorded between the 14th and 28th October and the 20th March and 4th April, (see Figure 10).

Verditer flycatcher. **Muscicapa thalassina.**

Recorded between the 3rd November and 22nd February. A Winter visitor in small numbers.

Greyheaded flycatcher. **Culicicapa ceylonensis.**  
Resident, one of the commonest species in the wetter forests elsewhere in the Ghats. Capture of a recently fledged juvenile on the 13th July is the first proof of breeding for the species in the Ghats.

Whitebrowed fantail flycatcher. **Rhipidura aureola.**

Seen on several occasions between September and November in a deciduous forest area, and again in February and March and in May and June when in full song.

Whitethroated fantail flycatcher. **Rhipidura albicollis.**

Resident in secondary growth areas. Nest building noted on the 10th April.

Blacknaped blue flycatcher. **Monarcha azurea.**  
Common breeding bird but only rarely recorded during December and January, although more in evidence during January of 1978, apparently facultatively moving to lower elevations during the dry season (Figure 10). A previously unrecorded song "a ringing chew chew chew", resembling the Tailor Bird was heard on the 1st June and on several occasions in the two weeks subsequently. This song was also heard by Mr. S. A. Hussain of the Bombay Natural History Society and myself in Borivli National Park, near Bombay on the 27th July.

Paradise flycatcher. **Terpsiphone paradisi.**

Several individuals were captured in March, 1972. Not recorded at Lammasinghi during the study period, although two pairs, probably breeding, were located near the foot of the Ghats near Downeru on the 30th April, and an immature was seen three kilometres away on the plateau on July 10th.

Ashy-grey wren-warbler. **Prinia hodgsonii.**

Inconspicuous, in parties or singly throughout the dry season. Song prominent from March onwards, and in January 1978.

Ashy wren-warbler. **Prinia socialis.**

The commonest wren-warbler. During the dry season wanders into forest clearings from the secondary growth. Food being carried to young in the nest seen in September and in June.

Jungle wren-warbler. **Prinia sylvatica.**

Common elsewhere, on the drier, more scrubby areas of the plateau. One pair was still breeding in October: and independent juveniles noted on the 6th July. In addition to the "sihoot" song noted by Ali and Ripley (loc. cit.), (the note repeated once per second in runs lasting up to thirteen minutes), there is a second song "weecho" repeated 15-20 times at a rate of two per second, followed by a pause and repeats of the sequence. A male watched for the whole day on the 18th September, at a time when his mate was laying spent 85 minutes in song; dividing his time equally between the two song types. Long runs of song were confined to the morning. The "sihoot" song more conspicuous during April and May.

Tailor bird. **Orthotomus sutorius.**

Common resident, seen individually or in pairs. On the weekly post-dawn walk approximately twice as many birds were calling during the wet season (June) compared with the dry season (January).

Grasshopper warbler. **Locustella naevia.**

Two records only: on the 31st January and on the 5th February, 1978.

Thickbilled warbler. **Phragmaticola aedon.**

Scarce winter visitor. Recorded only between 27th January and the 28th April. One individual was known to have stayed in the area during this time.

Blyth's reed warbler. **Acrocephalus dumetorum.**

First arrivals on the 21st October, with an influx in the beginning of November, having gone through a complete moult further north in the peninsula (Gaston 1975). At least half of these birds maintained territories throughout the Winter. Departure at the end of April. There was an influx of birds in mid March (see Figure 10). The last record was on the 16th May. Some song was noted just prior to departure.

Tickell's leaf warbler. **Phylloscopus affinis.**

An adult and juvenile captured together on the 14th November are the only records.

Yellowbrowed leaf warbler. **Phylloscopus inornatus.**

Widespread winter visitor to the whole plateau.

Largebilled leaf warbler. **Phylloscopus mag-nirostris.**

Commonly recorded on passage between the 29th September and the 21st October and the 6th April and the 27th April. Restricted to the undergrowth of the mature forest, in contrast to the habitats occupied on its breeding and wintering grounds. (Ali and Ripley, loc. cit.)

Greenish warbler. **Phylloscopus trochiloides.**

The subspecies *ludlowi* is an abundant Winter visitor, first recorded on the 30th August. Arrival continues until the third week of October. Departures are over the last two weeks of April and the first week of May; birds were



recorded as late as the 23rd June. All individuals are territorial. Song is heard regularly during territory establishment (from both sexes) and prior to departure (probably from males only). Song is also heard occasionally through the Winter; there is evidence that this involves an attempt by one bird to expand its territory at the expense of another as in Grey Wagtail (see below, Price, 1978). 10 out of 15 (66%) of the colour ringed birds holding territories not disturbed by felling operations returned in 1978. The subspecies *viridanus* was recorded occasionally during passage months, and a bird closely resembling the subspecies *nitidus* trapped on the 8th November.

Large crowned leaf warbler. ***Phylloscopus occipitalis***.

Uncommon Winter visitor.

Greyheaded flycatcher warbler. ***Seicercus burkii***.

A record on the 25th March 1972 and one from the 4th November. An uncommon Winter visitor, apparently at the southern edge of its winter range.

Rubythroat. ***Erithacus calliope***.

Widespread winter visitor to the Ghats, recorded at Lammasinghi between the 19th October and the 2nd April (Figure 10). Some song in early November, also heard in January, 1978.

Bluethroat. ***Erithacus svecicus***.

A juvenile was trapped on the 16th December. This bird winters at low densities on the plateau in the wetter open areas.

Bluechat. ***Erithacus brunneus***.

Recorded on passage in the last two weeks of October, the last week of April and the first week of May. A few birds over winter, there being records for all Winter months (Figure 10).

Magpie robin. ***Copsychus saularis***.

Resident and summer visitor. Birds come into song in March, most song is heard in April, the amount per bird decreasing during May (Figures 10 and 12). First independent young seen on the 26th May. Adults in mid June are inconspicuous, either moulting or having departed. Wintering birds are confined to the area of secondary growth, although some breeding takes place in the moist deciduous forest.

Shama. ***Copsychus malabaricus***.

Resident. See Figure 11A. In June it is the only conspicuous early morning songster. First young noted on the 31 May.

Stone chat. ***Saxicola torquata***.

One specimen captured in March 1971. Winters in small numbers on the wetter, more open areas, higher on the plateau.

Pied bush chat. ***Saxicola caprata***.

Resident and Summer visitor. Pairs and single females held territories through the Winter. There was an influx of males and an increase in song through January and February. First fledged young noted on 1st May. Independent young in June when adults are inconspicuous. The only time song was noted from October to December was between two males; one intruding into an established territory.

Indian Robin. ***Saxicoloides fulicata***.

Only two records from Lammasinghi during this study although it was recorded commonly in April 1972. More common elsewhere on the plateau and abundant on the coastal plain.

Blueheaded rock thrush. ***Monticola cinclorhynchus***.

Four records from the last week of October, one from November, two each from January and February and five from March. All November to February records are of males. Noted in 1971, 1972 and 1978 also. This ex-

tends the Winter range of this species south east from Madhya Pradesh.

Blue rock thrush. **Monticola solitarius.**

A single sight record on the 14th October. This species winters on the rocky peaks above 3,000 feet elsewhere in the Ghats, e.g. near Solabum.

Pied ground thrush. **Zoothera wardii.**

A female on the 6th October, and males on the 27th October and 6th April are the only records. Passage migrant.

Orangeheaded ground thrush. **Zoothera citrina citrina.**

Resident, particularly common in the undergrowth of the moister mature forests. Infrequent songster. A notable capture was that of a pair ringed together as adults on the 11th May 1972 and recaptured together on the 27th April 1977.

White's mountain thrush. **Zoothera dauma.** Recorded on the 31st March, 6th and 13th April only, extending the wintering range south from Sambalpur in Orissa.

Tickell's thrush. **Turdus unicolor.**

Recorded only on three occasions in the second two weeks of November. Previously recorded in the area in February (Whistler and Kinnear 1932) and two small flocks (c. 15 birds each) noted in January, 1978 may have been of this species.

Blackbird. **Turdus merula.**

Resident, particularly common elsewhere in "shola type" forests in the Ghats. There was an influx into the area in November to feed on large numbers of earthworms that came to the surface.

Blackspotted yellow tit. **Parus xanthogenys.** Birds may remain as pairs throughout the year. Song and display first noted in January, accompanied by dispersal mainly of females.

Maximum song and nest building in May. Family parties noted in July and September and a few parties of up to five birds noted throughout the Winter months.

Chestnutbellied nuthatch. **Sitta castanea.**

Resident, singly or in pairs outside the breeding season.

Velvetfronted nuthatch. **Sitta frontalis.**

Resident, invariably seen in pairs or parties of up to five birds outside the breeding season. A previously unrecorded behaviour is that of vigorous wing flapping, commonly seen on tree trunk faces, apparently attempting to flush insects.

Hodgson's tree pipit. **Anthus hodgsoni.**

Winter visitor. Noted from the 30th October to the 19th April, (Figure 10). Particularly common in January, when loose flocks of up to 30 birds recorded. Generally confined to the secondary growth area, occasionally seen within the forest.

Forest wagtail. **Motacilla indica.**

Recorded on passage between the 19th September and 24th October when up to four birds joined the Grey Wagtail roost. Singles on passage on the 1st and 27th April.

Grey wagtail. **Motacilla caspica.**

Present at least from the 26th August to the 18th April. During September and October large flocks, presumably containing many passage birds were recorded at roost. 150 birds roosting in a large *Ficus* on the 14th September increased to 680 on the 19th September. A decrease in October was accompanied by an increase in another *Ficus* to a maximum of 720 present on the 25th October.

Birds arrived at the roost up to one hour before entering it, in parties of up to 30 individuals, and departed in flocks of five to 470, flying west over the plateau. No feeding flocks



were ever noted. Over wintering birds are territorial during the daytime although roosting together. About 35 individuals were regularly recorded at roosts between November and February. Two birds holding adjacent territories along a road were colour ringed. These were seen displaying and singing at each other on 11th December, after which one bird disappeared. The other then occupied both territories until the beginning of April and returned to them over the 1977-1978 Winter.

Thickbilled flowerpecker. **Dicaeum agile.**

Resident, less common than Tickell's Flowerpecker. There is a rambling song of the general tone of the Ashy-grey Wren Warbler, containing mainly mixed up call notes; heard on several occasions through the year.

Tickell's flowerpecker. **Dicaeum erythrorhynchos.**

Common, the most abundant species in the dry deciduous forest on the hill tops.

Purplerumped sunbird. **Nectarinia zeylonica.**

Common, breeding mainly early in the year. One pair noted with three nesting attempts (all destroyed) between the 9th March and 27th April.

Purple sunbird. **Nectarinia asiatica.**

Approximately as common as the Purplerumped Sunbird; far more common elsewhere in the Ghats in the higher forested areas. Only a single male seen in breeding plumage during September-October, main breeding period in the early months of the year.

Yellowrumped sunbird. **Aethopyga siparaja.**

A male recorded at *Eucalyptus* flowers during the first week of January extending the Winter range south from Orissa. In January 1978 four males (one trapped) were seen between Gudem and Merripakala. It should be noted that the yellow rump is completely obscured

in the field during the Winter by an overgrowth of green flank feathers.

Little spiderhunter. **Arachnothera longirostris.** Captured in March 1971 (Raju and Selvin 1971) and in March 1972. Only noted during this study on 19th September. Elsewhere in the Ghats noted along watercourses between Gudem and Merripakala on the 14th April and near Thajangi on the 12th January 1978.

White-eye. **Zosterops palpebrosa.**

Abundant, resident. Pairs or individuals are regularly recaptured at the same net site throughout the year. Large post-breeding flocks (up to 50 birds) are seen at fruiting trees and as the nucleus to mixed feeding flocks in the mature deciduous forest. In November these flocks break up, and many small flocks of up to 15 birds influxed into the secondary growth area. Small flocks were seen throughout the Winter period at nectar sources. No flocks seen in April and May. First nest building observed on 11th March. Several nests with eggs located at least up to July 3rd. Family parties begin to appear in mid June.

House sparrow. **Passer domesticus.**

Present in all villages.

Tree sparrow. **Passer montanus.**

First noted at Lammasinghi in April 1972 (Raju and Price 1973). An extensive survey of neighbouring villages was undertaken, in an attempt to determine the status of the Tree Sparrow in the Eastern Ghats. Just one individual was noted at Solabum, and a breeding population discovered at Bussalkort. Two nets were placed in Lammasinghi village for a morning each month (table 7). The state of birds in the hand and direct observation shows that the Tree Sparrow has a restricted April to June breeding season, while the House Sparrow breeds throughout the year. Small post-breeding flocks during July and August

were noted on the edge of the village. It is estimated that the population of Tree Sparrows at Lammasinghi is less than 200, and the total population size in the Eastern Ghats may be less than 500 and decreasing to extinction. Apparently this is the only place in the world where two species of *Passer* breed side by side in thatched roofs. There is an unconfirmed sight record of possible hybrid birds at Bussalkort.

**Baya. *Ploceus philippinus*.**

First recorded on the 15th June. Several pairs nested beside the paddy fields. The species was abundant at Lammasinghi in March 1972.

**Green munia. *Estrilda formosa*.**

Small parties of between four and eight birds seen on six occasions during May. Larger flocks noted in January at Gudem and during March and April near Thajangi.

**Whitebacked munia. *Lonchura striata*.**

Seen throughout the year; in September, April and May in flocks of up to 40 birds.

**Jerdon's munia. *Lonchura kelaarti*.**

Noted particularly through the Winter months when flocks of 20-30 birds may be seen feeding in litter on the edge of the deciduous forest. Rarely recorded between April and July.

**Spotted munia. *Lonchura punctulata*.**

Several pairs breeding and commonly seen between September and November. Only occasionally recorded between January and May.

**Common rosefinch. *Carpodacus erythrinus*.**

Recorded between the 19th November and the 9th April (Figure 10). The influx into the Eastern Ghats region probably occurs earlier; two birds were nearing completion of full moult on the 16th and 23rd December. Flocks of up to 150 birds seen at Gudem. In March

1972, 200 individuals were captured at Lammasinghi when large stands of *Lantana*—a favourite food source—were present.

SUMMARY

This paper reports on the results of a mist netting and observational study on the bird-life at one locality in the Eastern Ghats of Andhra Pradesh, India. Several range extensions south from the Similipal Hills in Orissa are recorded. The forested area is more important than hitherto thought as a Wintering ground for Palaearctic migrants and in particular as a stopover for passage migrants. Corresponding to seasonality in rainfall, food supplies are at their lowest levels from December to February. This correlates with the annual cycle of resident species, most of which breed from mid-April to June and moult from July to October, and the appearance of some larger insectivores and frugivores to breed in the Summer months. The various strategies adopted by different species to promote over-winter survival, and the possible impact of Palaearctic migrants on resident species are discussed.

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APPENDIX

The area within ten kilometres of Lamma-singhi includes at least three habitat types not encountered in the study area, and several new bird species. The habitat types are: (1) A ten year old reservoir at Thajangi, (2) Open, dry farmland on the plateau, (3) Farmland on the coastal plain. For the sake of completeness species observed *and identified* in these habitats, but never seen on the study area are detailed below.

Little egret. **Egretta garzetta.**

Up to 20 regularly at Thajangi reservoir.

Pied harrier. **Circus pygargus.**

One near Thajangi on January 6th. Pallid harriers, *C. macrourus*, and probably Hen harriers *C. cyaneus* also occur on the plateau.

Wood sandpiper. **Tringa glareola.**

One on March 22nd beside the river near Thajangi. A regular migrant on the plateau.

Painted snipe. **Rostratula benghalensis.**

Two on January 10th 1978 near Thajangi associated with other snipe, *Gallinago* sp. The *Gallinago* snipes are regularly seen at Lamma-singhi in January.

Swallow. **Hirundo rustica.**

Several at Thajangi reservoir on April 1st. A

large flock at Sileru on April 9th.

Wiretailed swallow **Hirundo smithii.**

2 at Thajangi reservoir on April 1st.

Black drongo. **Dicurus adsimilis.**

Common on the coastal plain, and seen occasionally on the more open parts of the plateau.

House crow. **Corvus splendens.**

Common on the coastal plain. Never recorded on the plateau.

Whiteheaded babbler. **Turdoides affinis.**

Common on the coastal plain.

Streaked fantail warbler. **Cisticola juncidis.**

One in mid June on the open plateau. Common at higher, wetter elevations (Price, in press).

Paddyfield pipit. **Anthus novaeseelandiae.**

Occasionally seen on drier areas of the plateau.

White wagtail. **Motacilla alba.**

Three at Thajangi on January 11th.

Large pied wagtail. **Motacilla maderaspatensis.**

Two regularly seen at Thajangi reservoir.

Display noted at Sileru on April 9th.

Yellowthroated sparrow. **Petronia xanthocolis.**

Seen in bamboo clumps downhill from Lamma-singhi on April 30th. Fairly common on the coastal plain.

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